

The Blast Furnace *and* Steel Plant

Vol. XII

PITTSBURGH, PA., NOVEMBER, 1924

No. 11

Construction or Destruction Which?

DURING the last 148 years the United States has been built from a wilderness to the most thriving nation in the world. History contains no record of a people who have been so well favored. The progress made has not been the result of chance. The whole has been brought about by a carefully-mapped out program, which has been codified into laws and customs. These regulations are observed by all citizens having the welfare of the nation at heart.

The plan of government under which we are living is a known quantity. There is no guessing as to the future. In drawing conclusions, we unhesitatingly say our forefathers builded well.

In the year 1924 there has appeared a group who have taken the opposite view, and have said: "Our forefathers did not build solidly. Let us tear down the structure they erected. Let us destroy our laws and customs. The experience of peoples of thousands of years is all wrong. We will build a new system upon the ruins of the tried structure. Let us do away with the laws which give protection to all alike. Let us inaugurate plans that have brought ruin wherever they have been tried. Why? Because we are dissatisfied."

We need only review the history of our country to prove that the dissatisfied element is usually wrong. Take the "Know-nothing" party, the "Greenback" party, the "free coinage of silver," and greater than all these, the party which brought on the Civil War and sought to separate the country into two nations instead of the one United States. Every man who worked, voted and fought for these radical changes is happy today that these political projects were defeated.

This publication is not devoted to political questions, but it is vitally interested in the welfare of the nation. Each of us must decide at this November election whether we favor the parties of construction or those of destruction.

(Signed) L. L. CARSON.

Optimism Pervades Convention

Leaders of Industry Enthusiastic at Atlantic City Gathering of
American Gas Association

By F. J. CROLIUS

THERE is no danger of a saturation point in the domestic use of gas service so long as the population of the United States remains one of home dwellers and the price of solid fuel remains so high as at present, according to Samuel T. Bodine, president of the United Gas Improvement Company of Philadelphia, at the sixth annual convention of the American Gas Association.

His statement, which carried with it optimistic assurances of a restoration of business confidence and activity, was one of several made as part of a nationwide survey by the association to ascertain the economic and industrial conditions in the country.

Mr. Bodine does not consider the expansion now taking place in the manufactured gas industry as in any way phenomenal. He said: "It is running at about the same compounding percentage which has obtained since the gas-men of the country, awakening from their conservatism in the conduct of the commercial department of their business, have proven that gas, manufactured under improved process and utilized through improved and more efficient appliances, has become a vital factor in domestic comfort and manufacturing economy."

Thomas N. Carter, president of the Public Service Electric and Gas Company of New Jersey, stated that so far as that part of New Jersey served by his company is concerned, the prospect for the gas industry is bright.

Competition with other cheap fuels, such as oil, has stimulated the gas industry on the Pacific Coast so that it is actually ahead of other business developments, in the opinion of F. A. Leach, vice president and general manager of the Pacific Gas and Electric Company.

The views of such broadly informed experts was reflected throughout the week's convention by a marked feeling of optimism as to general conditions.

The American Gas Journal summarized the Association's meeting in part as follows:

The Big Show at the Pier.

To the 1924 exhibition of the A. G. A. there came with the finished fruits of brain and brawn nearly 170 exhibitors, to show these marvels and to explain their virtues for the profit and instruction of those from all corners who, like the writer hereof, have so much yet to learn about a business that means such volumes to the national wealth and prestige, such sustenance to the all successful industry and such surcease of toil to the tired housewife.

The visitors noted a bewildering variety of displays appealing to their imagination, to their sense of appreciation for painstaking achievement and to their pride in the consciousness that the wonders wrought by the manufacturers of gas and of the metallic agencies for its use were the triumphs of American capitalists and engineers.

A lure that led so many inside the doors of the exhibition halls was the display of a series of paintings

by F. L. Stoddard, in vivid tones and blazing conceptions, forming what might be named the Pictorial Epic of Gas. These images were irresistible. Folks went, they saw, they were intrigued and they stayed long to marvel.

Even the almost wholly educational and promotional phases of the booths held out something to touch the imagination. (Item: the dumb but eloquent figures showing that a single public service in a single state had swollen its sales of gas by nearly three billions of cubic feet since 1920—and had performed other feats in expansion that made the head swim to ponder them.)

Many great and magic names in the factory firmament appeared on the list of exhibitors and were draped tastefully as well above the booths in the harmonious uniform design made mandatory by the association. The bigger hall where this miniature world fair is going on, banked high with evergreen trees and streamers too, and strung with myriad electric bulbs, made a festive stage setting for the glorification of gas.

Flames of it spouted or glowed here and there from pipes to help tell the mystery of the latest machinery on the market. Pipes themselves, in all sizes and shapes, invited inspection. Castings, gauges, meters, also huge coal crushers. Movie cameras attached to new motors and showing the picture of the motor working along with the motor itself. Gas heaters, all styles and sizes. Girls cooking sweets now and then and asking you to have a nibble.

Then, as a climax, the story of coal mining as set out with working models and pictures and lay figures by the United States Bureau of Mines.

Alexander Forward Presents Statistics. Steady Progress In Industry.

A sketch of the important items in the statistics of the industry for 1923, as compiled and analyzed by the association's statistical department, demonstrates that during last year the industry continued to enjoy the steady march of former years. The total gas produced and purchased for public distribution in 1923 was 418,000,000,000 cubic feet. For the first time we crossed the mark of 400,000,000,000 cubic feet in a year.

It is interesting to note that of the gas actually manufactured in the plants, approximately 74 per cent is carburetted water gas, 19 per cent is coal gas, and approximately 8 per cent is oil gas. The coal gas manufactured shows an increase of about 6,000,000,000 cubic feet over the 1922 figure, while the carburetted water gas manufactured in 1923 shows a gain of approximately 8,000,000,000 cubic feet over 1922. Carburetted water gas seems, therefore, to be more than holding its position. This is, of course, due in part to the increase in some cities in house heating and similar loads, creating a peak load carried by additional water gas equipment. Due to the trend toward a lower content of British thermal units and to in-

creasingly efficient methods, we are using proportionately less oil, thus aiding conservation of natural resources in this direction.

Increase In Coke Over Gas.

An important feature is the marked increase in coke oven gas purchased and mixed with manufactured gas for city use. In 1921 the amount of this gas purchased was 37,000,000,000 cubic feet; in 1922 this figure increased to 55,000,000,000 cubic feet and reached approximately 66,000,000,000 cubic feet in 1923 — or about 8,000,000,000 cubic feet more than the coal gas manufactured for that year. This represents an increase of approximately 80 per cent between 1921 and 1923.

If this purchased coke oven gas is added to the coal gas manufactured, the combined 1923 figure will show an increase over 1921 of approximately 25,000,000,000 cubic feet as against 24,000,000,000 cubic feet for carburetted water gas—and a percentage increase of 25 per cent as against 11 per cent. From this standpoint the anticipated trend toward the increased use of coal gas is justified. However, these figures clearly show the strong position both of coal gas and of carburetted water gas.

Gas Industry Using More Coke.

In considering the raw materials used for the manufacture of gas it is interesting to note that in 1921 the ratio of coke to anthracite coal used for gas manufacture was as 57 to 43, whereas in 1923 the ratio was as 75 to 25. Coke is a product second only to gas in importance to the industry and its increasing use in our own manufacturing processes will be welcomed by any gas men. Of the coke used in 1923 40 per cent was coke made by combination coal and water gas plants as a by-product of their coal gas manufacture and used as a generator fuel in their water gas machines. Such control of an essential raw material is a factor of strength for any industry.

Gas Sales.

The total annual sales of gas for the year 1923 are reported as a little over 384,722,000,000 cubic feet, an increase of approximately 9.87 per cent over the annual sales in 1922. A comparison of the 1923 sales with the gas produced and purchased for the same year indicates "unaccounted for gas" of approximately 7.94 per cent as compared with 9.18 per cent in 1921, the last year for which official statistics were published by the association. This reduction in gas unaccounted for is probably due not only to increased efficiency but to the increase in the amount of coke oven gas purchased.

Our sales in 1923 were more than double the annual sales for 1913—the increase in sales for the 10 years more than equaling the total output for the year prior to the outbreak of the World War. In this decade the sales of manufactured gas practically equal the total sales of gas during all of the preceeding 40 years.

Increase In Industrial Gas.

The analysis of sales according to uses indicates that 24.02 per cent of the total sales for 1923 (or slightly over 92,000,000,000 cubic feet) were used for industrial purposes. In 1921 the industrial sales represented 21.62 per cent of the total, or a little over 70,000,000,000 cubic feet. In two years therefore our sales for industrial purposes have increased by nearly 22,000,000,000 cubic feet, a ratio of increase of 30 per cent. It has been stated that our sales for 1923 are double those for 1913. It is interesting to note that the industrial sales for 1923 represent 47 per cent of this increase, as the sales for industrial purposes in 1923 were practicably negligible.

Technical Section.

Under authority of and appropriation by the Executive Board, the Committee on Measurement of large Volume of Gas has just completed a series of tests to determine the relative accuracy of large volume meters including such types as the Standard Orifice

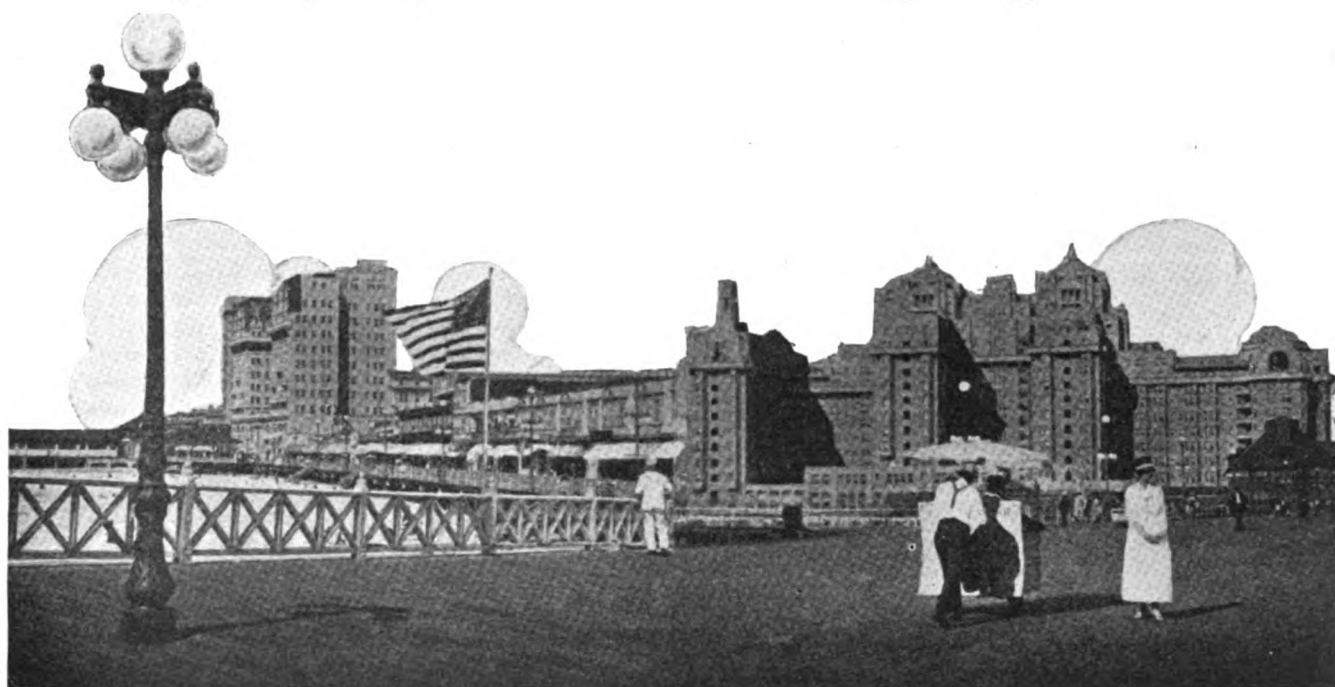


FIG. 1.—A familiar view along Atlantic City's Boardwalk where the American Gas Association, Sheet Steel Executives and the American Hardware Association held meetings simultaneously.

Meter, Pitot Tube, displacement meters, Venturi Tube and Thomas meters. The results of these tests will be particularly important to companies purchasing large volumes of coke oven gas and in connection with the metering of large volume industrial sales.

Included in the tremendous variety of exhibits, each of which carried some point of interest to 5,000 or more visitors who thronged the Pier were many innovations of peculiar value to those members of the steel fraternity who were fortunate enough to be present.

The Kolumbus Coke Separator, shown in the accompanying figure, meets a need long felt wherever fuel is burned.

The "Kolumbus" Coke Separator is a simple and efficient machine which separates from ashes practically all the unburned fuel in usable form. It handles all the ashes from either coal or water gas generators and, as illustrated above, delivers the reclaimed fuel, fine ash, large clinker lumps, and coarse clinker through separate openings into barrows or cars. In-

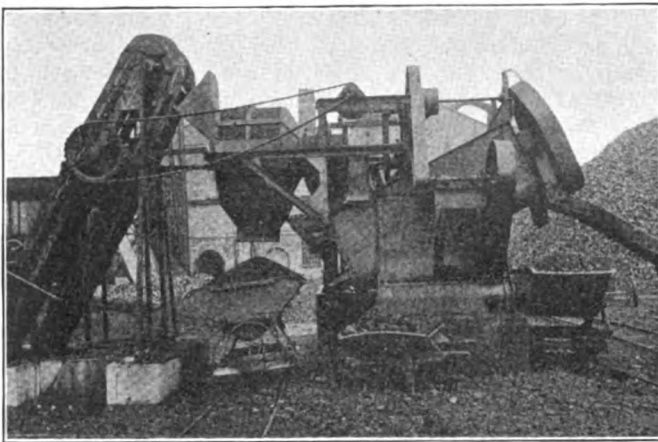


FIG. 2.—Showing the Kolumbus coke separator in operation, separating out from badly burned fuel a very high percentage of residual carbon.

vented in Germany about four years ago, on the market only about three years, the machines in use already number over 700. Their use has extended among the larger gas works and industrial plants in European countries, until today these machines have been distributed to coal and coke burning plants as far away as Japan, Australia, and New Zealand. They are now being introduced into the United States by Ash Reclaiming Machinery Corporation.

The very practical development of the Radiant Heater in unit construction should be a boon to present sufferers in natural gas areas. A cross-section of the heating element is shown in Fig. 3.

Gas makers showed unusual appreciation of the U. G. I. Model "B" control, which seems to possess exceptional features in gas works operation. This compact control unit is shown in Fig. 4. Among its many advantages may be cited:

The length of cycles may be changed at any time during the operation of the gas apparatus without shutting down to make such change. No other adjustment is necessary outside of shifting the gear ratio of the cone gear, which gives a positive cycle length.

(Continued on Page 524.)

Glorifying the Influence of Power

An important purpose of the Power Show is to glorify power and its tremendous influence in advancing American civilization. The Third National Exposition of Power and Mechanical Engineering, which is the official name for the Power Show, will be held from December 1st through the 6th. Its stage will include 150,000 sq. ft. in the three stories of the Grand Central Palace. Its entertainers will consist of 3200 representatives of over 300 exhibitors, well trained in their art and ready to dispense information and satisfaction to the audience of 75,000 who will view the magnificent display of machinery worth many millions of dollars that will be on view and partially in operation during the week of the show. That an annual spectacle of this character has become so thoroughly established in three short years, is definite proof that the economical production, distribution and utilization of power is coming to be generally understood as the foundation of industrial progress. The show is appreciated as the annual opportunity for engineers and industrialists to become acquainted with the tremendous developments in mechanical engineering compelled by the ever-increased demand for power.

The holding of the Power Show at the same time as the great annual gatherings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers, and with the wholehearted co-operation of the American Society of Heating and Ventilating Engineers and the National Association of Stationary Engineers, gives an educational status to the event and attracts designing and constructing engineers and operating men who are fully aware of its tremendous significance. But it is also an object lesson to the general public in that it shows something of the complicated organization of apparatus out of sight but ready at the closing of the switch or the pressing of a button to illuminate the face of the earth and do the work of its people.

One of the aspects of the success of the Power Show in the past years, not generally understood or appreciated, is the excellent opportunity it offers to engineers and purchasers to become acquainted with the personnel of the selling organizations represented at the show as well as the devices on exhibition. This acquaintance promotes the interchange of experience and information of far-reaching effect. The opportunity to compare competing devices under the same roof is time-saving and much more satisfactory than a pilgrimage from installation to installation.

The scope of the coming Power Show is inclusive of the entire range of power producing, distributing and utilizing apparatus. Steam-generating devices with the auxiliary materials and apparatus will be shown in abundance. Prime movers will be represented. Metering equipment, which has played such an important part in securing the excellent economies in modern steam plants, will occupy an important place on the stage. The using devices will include machine tools and transmission equipment, such as belting, bearings, couplings, etc. Every manufacturer and engineer will find much of real value in solving the daily problems of increasing economy. In addition to this a section of machine tools is being placed in the exposition to meet the demands made by engineers at the past two expositions for this type of equipment. Thus the exposition is extending its scope into further fields of mechanical engineering.

Electric Heating of Sheet and Tin Mill Rolls

Haphazard Results of Former Preheating Methods Now Eliminated

By GORDON FOX*

THE first turn each week in sheet and tin mills is commonly beset with more or less difficulty. The most serious drawback is the necessity of starting the turn with rolls greatly below normal rolling temperatures and bringing them up to proper temperature and shape. Even though the rolls be partially preheated by steam, gas flame or stack gases, it is ordinarily necessary to roll narrow iron and heavy gauges until the rolls attain temperature. In order to permit proper flow and distribution of the heat introduced into the rolls and to prevent excessive roll breakage, it is commonly the practice to restrict the production until the rolls are in suitable condition.

Electric preheating of the finishing rolls of sheet and tin mills is a new development which has demonstrated its ability to eliminate the first turn difficulties incident to cold rolls. By this means it is possible to put the rolls in mid-week condition before the mills are started so that production may proceed immediately on any desired order and at maximum rate. The pronounced superiority of the results afforded by electric preheating over any previous heating methods mark this development as a distinct improvement in the art.

Fig. 1 shows the appearance of an electric roll heater applied to a pair of rolls in position. The device comprises two frames each carrying two flexible cylindrical sectors. The frames are arranged to clamp a pair of rolls in place in their housings. The cylindrical sectors which carry the heating elements on their internal surfaces, fit snugly to the rolls. These sectors are lagged to confine the heat to the rolls. Due to the flexible feature and by means of take-up devices, the heaters will fit rolls varying in diameter due to dressing.

Roll heaters are made in sizes suited to 28 inch and 30 in. rolls respectively. Standard 28 in. heaters are suited for use with rolls from 27¼ in. to 28¾ in. actual diameter. Standard 30 in. heaters are suited for use with rolls from 29¼ in. to 30¾ in. actual diameter. To obtain the best fit it is desirable to vary the distance between roll centers according to roll diameters. Thus with a pair of rolls 27½ in. in diameter a separation of 1½ in. between rolls gives the best results. This requirement is best cared for by providing a pair of wedges tapering from 1/16 in. to 2 in. in thickness. These can be introduced between a pair of rolls as far as necessary to obtain the desired separation. If the wedges are applied from the proper side of the mill they may be rolled out when the mill starts, letting down the rolls without shock and making unnecessary the use of the crane for removing the wedges.

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Standard roll heaters are made in 24 in., 30 in., 36 in. and 44 in. lengths. It is recommended that they be used in accord with Table I. Where the same roll face is listed for two heaters the wider heater is recommended but the narrower heater may be used. If a narrow heater is applied to a wide mill the heat may be concentrated to an undesirable degree over the central portion of the roll. This condition is accen-

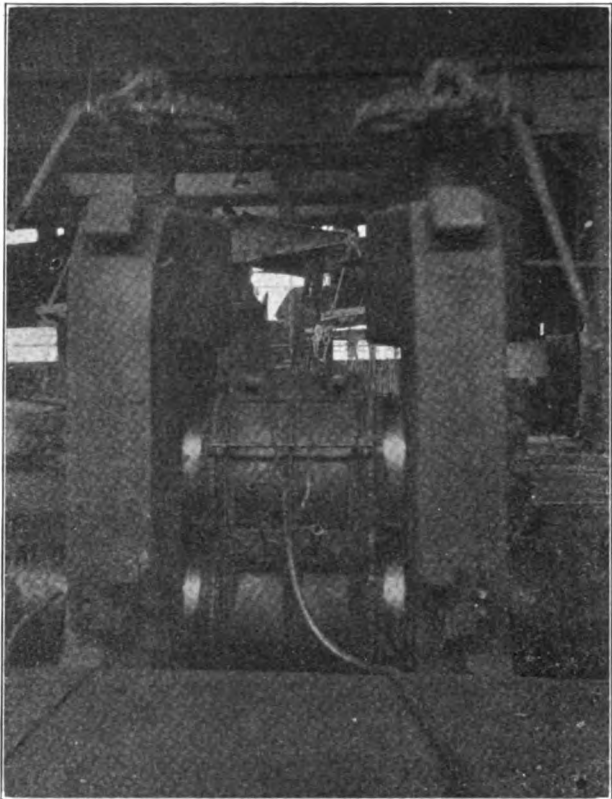


FIG. 1.—Showing electric heater in place on mill rolls.

uated by fast heating which establishes a considerable heat gradient or temperature difference between the center and the end of the roll face. A slow heat, as obtained by using the two heater halves in series, gives more uniform heat distribution over the length of the roll face. Therefore, when a narrow heater is used on a wide roll, it may be desirable to adjust the rate of heat application to suit in order to avoid a full mill.

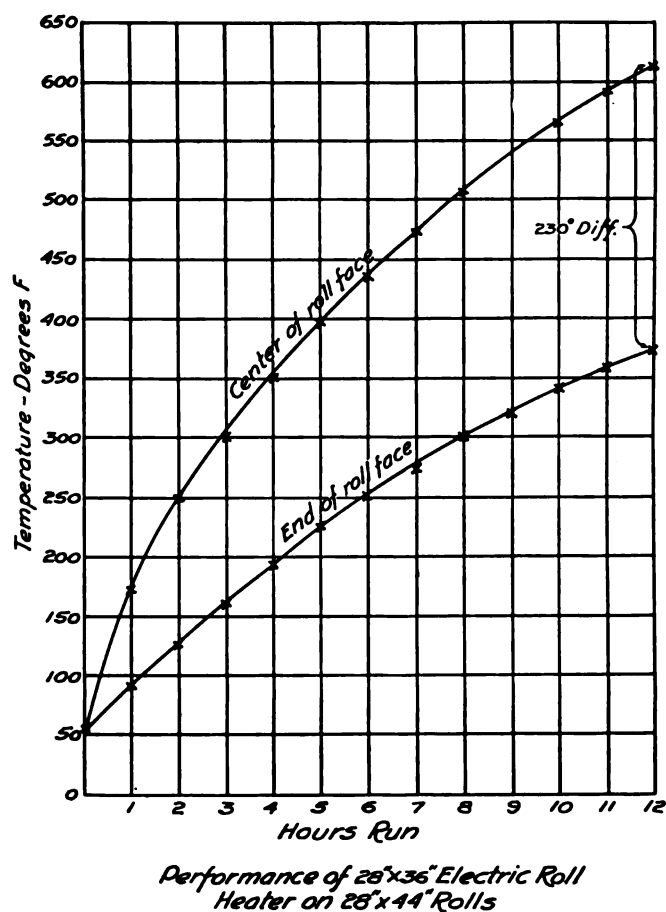
TABLE I — HEATER AND ROLL WIDTHS

Heater Width	Suitable for Rolls of Face Dimensions
24"	28" to 36" inclusive
30"	36" to 42" "
36"	40" to 48" "
44"	50" to 60" "

The manner and extent of heating of the rolls is best shown by Fig. 2 which gives the results of a test on a 28 in. x 44 in. mill equipped with a 28 in. x 36 in. heater. In this case the heating period was 12 hours and the final temperature at the center of the roll face was 617 deg. F. A moderate rate of heat application has been selected to approximate heating by rolling and to minimize expansion strains. It has been found entirely possible to bring the rolls to a temperature of 750 deg. F. but no benefit is apparent over results obtained with rolls starting at 550 to 600 deg. F.

It will be noted that approximately 230 deg. F. temperature difference exists between the center and

FIG. 2.



the end of the roll face at the expiration of the heating period. This difference corresponds closely with rolling conditions and approximates the difference necessary to remove the cross from the rolls. The design of the heating elements has been governed to secure this result. It is entirely possible, as previously intimated, to warm up to a "full mill" with the electric heaters but ordinarily the mill is a trifle hollow at starting with 2 in. or 3 in. fish tails on full width sheets.

The uniformity of heating is excellent. Although the entire periphery of the rolls is not directly covered by the heaters, the flow of heat is sufficiently rapid so that there is no appreciable variation nor the least corrugation nor distortion of the rolls. In an endeavor to detect any "out-of-round" condition, longitudinal strips have been cut from the first packs through the rolls. These strips were calipered for

gauge and found to be as uniform on the first pack as on any subsequent pack.

An interesting test was run on a 28 in. roll which had three holes drilled radially inward near the center of the roll face. These holes were 4 in., 10 in. and 14 in. in depth. Temperatures taken while warming up this roll electrically indicate that the interior of the roll heats up substantially as rapidly as does the surface.

Electric preheating gives temperatures much in excess of those attained by any other method of preheating other than the use of "warming-up" iron. Moreover, it is a definite method as contrasted with rather haphazard results obtainable with gas flame, exhaust gases, steam or hot water. Since electric preheating affords a definite result, the furnaces may be charged with no hesitation as to the condition of the rolls to handle the order charged.

The practical results obtained with electric preheating are measured by their performance in the several plants now using them. These plants now find it necessary, in fact rather undesirable, to roll narrow iron on a mill which has been electrically preheated. Many independent rollers have pronounced the rolls to be practically in mid-week condition at the beginning of the first turn. At one plant, 30 gauge, 36 in. wide, 96 in. long sheets are frequently rolled on a 44 in. mill with no preliminary orders and no extra passes and this mill has rolled 30 in. x 36 in. x 120 in. sheets in the first charge with entire success. This mill has made some excellent tonnages on the first turn. It may be definitely stated that warming-up iron may be dispensed with when rolls are electrically preheated and the tonnage on the first turn may be as high as on any other turn.

The amount of electric power consumed in heating the rolls depends upon their size, initial and final temperatures and the period of heating. Table II gives data applying to 28 in. rolls.

TABLE II
POWER CONSUMPTION OF ELECTRIC ROLL HEATERS

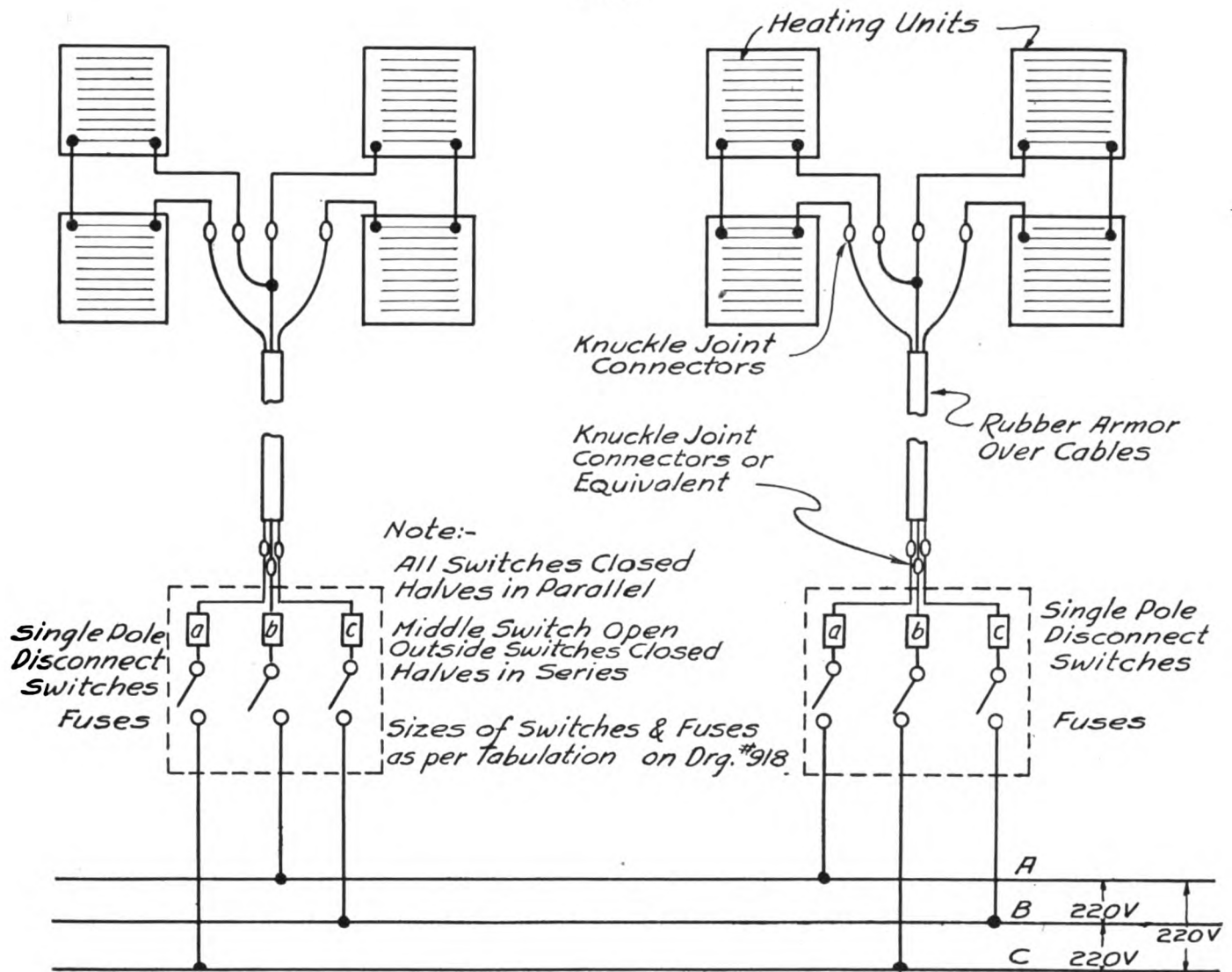
Heater Size, Ins.	Input, Kw.	Consumption in 12 hrs., Kwh.	Cost at \$.01 per Kwh.
24	39	468	\$4.68
30	48	575	5.75
36	56	672	6.72
44	72	864	8.64

A mill equipped with fourteen 28-in. diameter heaters of various widths recently consumed 8670 kwh. input to transformers, including all losses, over a heating period of approximately 12 hours.

The heaters present a uniform load. They may be used on low voltage direct or a.c. circuits as desired. If a.c. is used the power factor of the load, including feed lines and transformers, is about 90 per cent. It should be borne in mind that this is normally an off-peak load and occurs at a time when excess by-product fuels may be available. If power is purchased, the actual cost is represented by the consumption times the kwh. rate, independent of the demand charge.

As the heaters are applied to the standing rolls, no power is required to turn over the mill. The power required to turn over one pair of rolls is nearly as much as the input to one electric roll heater. The power required to turn over a cold mill and a hot mill is ordinarily more than the input to an electric

FIG. 3.



CONNECTIONS FOR ELECTRIC ROLL HEATER ON THREE PHASE SYSTEM

roll heater. As the mill is standing no attendance is required during the heating period.

The heaters are ordinarily handled by a crane. They are provided with swing bolts and ratchet wrenches, making their application and removal easy and rapid. The heaters are usually applied by the mechanics who set up the mills. This operation requires about 10 minutes. About five minutes are required to remove and store a heater and to rig a mill with the fore plates and rest bars ready for rolling. It has been found that, after the heaters are removed, the rolls drop in temperature about one deg. F. per minute, this small loss having no apparent bearing on the results obtained.

Electric heaters are now used in eight mills. One mill, which is fully equipped with 14 heaters, has worked out to a nicety the matter of handling and storage of the heaters. Moveable racks have been constructed, each receiving three heaters or six halves. These racks are carried by the crane and distributed along the mill. When the heaters are removed from the rolls they are deposited directly upon the racks

with a minimum of crane movement. The upper clamp bolts of the heaters are swung into engagement, holding the halves rigidly in place. After the mills are cleared the racks are carried down the mill out of the way and rolled into a lean-to on their own wheels. At this plant the 14 stands have been cleared and the mills turned over 21 minutes after the current was cut off the first heater. As there are 7 stands in each line, each unit of 7 stands turns over about 11 minutes after current is cut off. Thus the delay incident to the use of the heaters is very small indeed and of little moment in view of the great time saving due to immediate capacity production.

Electrically, the installation of roll heaters is simple. A suitable source of alternating or d.c. of proper capacity is necessary. Alternating current is generally preferable as conversion losses are thereby avoided. It may be necessary to install transformers to provide the necessary power. A three phase line is then extended the length of the mill line with taps at columns near the furnaces. The necessary switches are ordinarily located on these columns. Removable cables

are arranged to connect at these switch boxes extending to the knuckle-joint connectors on the roll heaters.

It is considered desirable to provide for connection of the heater halves either in series or in parallel. The series connection affords a slow heat suitable for removing the frost from very cold rolls or for maintaining the heat while permitting it to spread, as when a narrow heater is applied to a wide roll. The series-

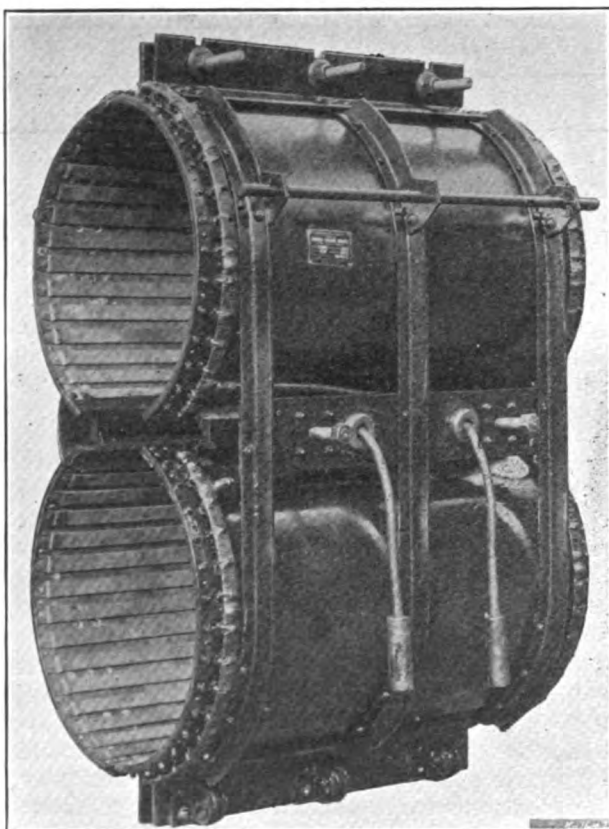
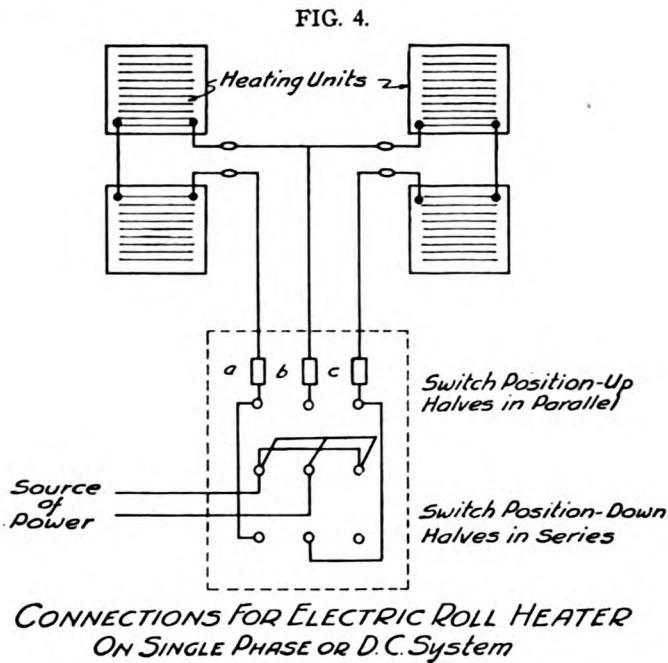


FIG. 5.—An excellent view of an electric roll heater ready for installation and service.

parallel arrangement may be derived by use of a three pole double throw switch as shown in Fig. 4 in which case the power is d.c. or taken from a single phase. Fig. 3 shows a method of securing the desired result with one 3-pole single throw switch, connected to a three phase system. The various heaters are connected to different phases in a manner to approximately balance the demand.

To date no roll breakages attributable to warming up have been reported on mills using electric pre-heaters. A considerable saving due to decrease in roll breakage is indicated but not yet established as a certainty. During the winter months it is recommended that the heater halves be connected in series to give a slow heat during the first hour or two to take out the frost before full heat is applied.

Electric heaters have been frequently applied to rolls in a rack to preheat prior to a mid-week change of rolls with admirable results. One plant keeps a pair of rolls hot at all times by use of an electric heater thus applied.

Symposium on Corrosion

At the Baltimore meeting of the American Chemical Society which will be held during Easter Week, the Division of Industrial and Engineering Chemistry will hold a symposium on corrosion. At the present time the tentative outline of the symposium is as follows:

- 1—Submerged corrosion of metals
 - a. Iron and steel
 - b. Non-ferrous metals
- 2—Atmospheric corrosion
- 3—Corrosion of special alloys

It is hoped that the scope of the papers of this symposium will cover the problems of corrosion in the heavy chemical industry, in the special chemical industry, in the marine world, in ordnance equipment, in the oil industry, mining industry, etc. Papers relating to any of these subjects or subdivisions will be welcomed by the chairman of the symposium, who is Robert J. McKay.

In case one plans to present a paper before this symposium he should correspond at once with Mr. McKay or the secretary of the division, Erle M. Billings.

The Tennessee Coal, Iron & Railroad Company, Birmingham, Ala., is said to have plans under way for additions in its plant at Fairfield, Ala., to cost in excess of \$500,000, including buildings and equipment. The primary work will consist of an addition to the blooming mill, designed for the production of small billets, with increased power facilities and auxiliary mechanical equipment. It is purposed to proceed with the expansion at an early date. George W. Crawford is president.

The Wisconsin Steel Company, Chicago, Ill., has authorized extensions at its plant at South Chicago to provide for considerable increase in capacity. The work will include a new 40-in. blooming mill, for which the machinery will be furnished by the Mackintosh-Hemphill Company, Pittsburgh, Pa. Other subsidiary expansion will be carried out. The reported cost is placed at close to \$500,000.

THE SAFETY CRUSADE

National Safety Meets at Louisville, Ky.

3,500 Members Elect Officers and Hear Vital Reports

National problems of accident prevention in America affecting the industries, railroads, mines, the schools, the homes and the general public were given close study at the 75 sessions of the Thirteenth Annual Safety Congress of the National Safety Council held at Louisville, Kentucky, September 29 to October 3. Approximately 3,500 were in attendance including representatives from Canada, Alaska, and other distant parts. Of particular interest were the crowded public safety sessions held at the latter end of the Congress. Every meeting was excellently attended. While possibly not the biggest safety congress it was the unanimous judgment that this year's convention from the standpoint of actual benefit to the safety movement was the best ever held. Louisville industries and civic organizations co-operated wholeheartedly in making the Safety Education Week and the Safety Congress a success.

Carl B. Auel, of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., was elected president of the National Safety Council to succeed Lewis A. DeBlois of Wilmington, Del. Mr. Auel was previously vice-president in charge of general activities and has for years been actively identified with the accident prevention work of his own company and with the safety movement at large. Mr. DeBlois becomes vice-president in charge of general activities.

The first day, Monday, was given over to the annual meeting of members in the morning and a general session in the afternoon. Among the speakers at these two meetings were Secretary of Labor, James J. Davis; Richard F. Grant, President, Chamber of Commerce of the United States; C. F. Kettering, Vice-President and Chief Engineer, General Motors Research Corp., and Dr. Arnold L. Jacoby, Director, Psychopathic Clinic, Detroit.

Another general session combining education and public safety was held on Tuesday afternoon with George H. Pride, Autocar Company, Ardmore, Pa.; Ernest N. Smith, General Manager, American Automobile Association and Judge Shepard Bryan of Atlanta as speakers. The public safety sessions were devoted to city planning and safety, accident statistics and how to use them, traffic studies and education of drivers and pedestrians. Noted city planning engineers, educators, state motor vehicle officials and police officials spoke.

Secretary Davis, in his address, urged closer co-operation of the industries in the collection of accident data and the minimizing of industrial accidents.

Mr. Grant declared: "It is a matter of great public concern and interest that the question of safety has

now assumed national proportions and is enlisting the unselfish work and devotion of men from all walks of life in an effort to find the best possible solution of the hazards of our complicated present-day life. The service in keeping this vital question before the public. It is to be congratulated that its work in traffic safety now enlists the attention of federal authorities and that there has been brought into a national conference the leading men of the country, both official and non-official in the solution of these complex problems."

There is no field of greater fertility for profitable scientific research than that of the mental factors entering into accidents, according to Dr. Jacoby. "The expenditure", he said, "upon the investigations of the minds of machine operators, of but a small fraction of the amount of money that has been expended in the manufacture of safety signs alone would be productive of valuable results. As a result of such investigations, not only will there develop better methods of examination to separate mental hazards, but also better methods of education through the media of signs and instruction."

Touching upon public safety, Dr. Jacoby said: "If traffic officers were to pay more attention to those drivers who manifest dangerous egotistic attitudes in their driving and less to the arrest of individuals driving beyond the legal speed limit on an open road, where no danger could possibly result; we might expect some improvement."

Officers Elected, 1924-25.

President, Carl B. Auel, Westinghouse Electric Company, East Pittsburgh, Pa.

Vice-President: In charge of Public Safety, David Van Schaack, Aetna Life Insurance Company, Hartford, Conn.

Vice-President: In charge of General Activities, Lewis A. DeBlois, E. I. du Pont de Nemours & Company, Wilmington, Del.

Vice-President: In charge of Public Relations, Lew R. Palmer, Equitable Life Insurance Society, New York City.

Vice-President: In charge of Local Safety Council, George T. Fonda, Fonda-Tolsted Inc., New York City.

Vice-President: In charge of Industrial Safety, Henry A. Reninger, Lehigh Portland Cement Company, Allentown, Pa.

Vice-President and treasurer: Charles B. Scott, Bureau of Safety, Chicago, Ill.

Secretary and managing director: William H. Cameron, Chicago, Illinois.

The Safety Bonus*

A Practical Plan, Successful in Mining, Which Offers Suggestions
for Steel Mill Application

By F. C. GREGORY†

THE "safety bonus" in metal mining is a sum in addition to the regular wage, paid to foremen or bosses for keeping the accident rate down to a specified minimum. It has been used with success for some time by certain companies as a regular part of their safety work. It is desirable from the employer's point of view in that the desired results in accident reduction must be accomplished before the bonus is earned; and from the standpoint of the recipient, in that he receives a reward for the additional effort which he has put forth in order to earn the bonus.

While this paper relates to the safety bonus as applied in the metal mining industry, the bonus system discussed herein will apply equally well to coal mining, oil-field work, and other mineral industries.

Various estimates have been made as to the percentage of accidents that can be prevented through physical safeguards, adoption of safe working methods, and other safety measures which can be initiated and carried out wholly through the management or the safety department. This percentage will always be a variable according to the local plant and conditions. But all who have been engaged in accident prevention agree that such work alone cannot bring the accident frequency down to where it should be, and that it is very necessary to work directly with the workmen, in an effort to make each individual do his share in making the work safe. In this latter phase of the work, the boss who has immediate supervision of the men is the one who can do the most, since he is in daily and frequent contact with the men while they are at work. In the metal mines, the shift and slope bosses are the key men; in the oil fields, the "tool-pushers" or sub-foremen, and the same applies to all industries. So it becomes necessary to keep these sub-foremen constantly interested in accident prevention, both because they are in personal touch with the men and because they are responsible for production and hostile to any plan which they think will interfere with their output. In large organizations it is the shift boss who represents the company and its policies to the man on the job.

The responsibility for seeing that the working places are "safe" goes with the shift boss' job, but it is not always taken as seriously as necessary to get the best results. There are many little things in a place which can be called "reasonably safe" which may cause accidents, and still may be overlooked or remedied, according to the attitude of the boss. In a plan whereby the bosses and men receive a bonus for production, safety details are very apt to be disregarded as all are willing to take more chances, in their efforts to increase their production bonus.

Through his intimate contact with the men under his direction, the shift boss has the best opportunity

of anyone in the organization, of influencing the attitude of the workmen toward accident prevention, and also can best keep in touch with their mental condition, as influenced by their home life and personal affairs.

If it is granted that these sub-foremen occupy the key positions as outlined above, it is surely well worth while to make an effort to see that they use that position to the best advantage in the prevention of accidents. They can be readily assembled for instruction in the essentials of such work and, with their co-operation, the work of the safety department is assured of a chance of success. It is true that much has been accomplished through these men without any other incentive than their interest in protecting their men, but the burden of production is placed on them, and unless the safety side of the work is also impressed upon them it is apt to be subordinated to production.

Where it has been tried out, the "safety bonus" has furnished the needed stimulus to the bosses to keep them constantly interested in keeping the accidents down to a minimum. The boss is impressed by the fact that the management will pay him real hard cash for helping to keep his men from being injured, and as a result of his desire to earn the bonus, he will put into his work the extra effort necessary to see that the men protect themselves.

The direct cost and results from the "safety bonus" can be estimated more closely than most plans for safety work, since a standard is established and there is no expenditure on the part of the management if this standard is not reached. The bonus must be earned before it is due. It is hard to estimate the total cost of accidents in an industry, as there are many obscure results — lost time from production by others than the injured, the expense of hiring and training new men to take the place of the injured employee, and the effect of a high accident rate on the morals of the men—are some of them. Adams* states that, computing the value of fatal accident at 6,000 days, the time lost through fatal and nonfatal accidents to the men employed in the coal and metal mines of the United States amounts to about one shift in 10. With wages computed at \$5 a day and compensation at 50 per cent of wages, the direct cost of accidents as measured by compensation only, is 25 cents per shift for each employee. It is believed that this is below the actual average in the industry.

Since few of the bonus systems in operation are the same in detail, an outline of four plans, all considered fairly satisfactory, are outlined below.

1. Each shift boss who supervises 2,500 shifts without a lost-time accident† shall receive a bonus of \$30. No penalty for an accident shall be imposed

*Modern Mining for October.

†Mining Engineer, Bureau of Mines, Department of the Interior.

*W. W. Adams, Metal Mine Accidents, Bureau of Mines.

†A lost-time accident is one where disability lasts beyond the day of injury but less than 14 days.

except that all credit up to the day of the accident is lost; the new bonus period starting on the following day. A yearly bonus of \$100, shall be given to the foreman having the best record for the year. Seriousness of accident, if disability is beyond day of injury, is not considered.

2. A monthly bonus shall be paid to both foremen and shift bosses for accident prevention, with 1,000 shifts as a base. For shifts above or below this number, the bonus is in proportion.

For foremen supervising 1,000 shifts:

No bonus when lost time exceeds $1\frac{1}{2}$ per cent of time worked.	
With no lost-time accidents†.....	\$50
With lost time from accidents less than $\frac{1}{2}$ per cent of time worked.....	40
With lost time from accidents less than 1 per cent of time worked.....	30
With lost time from accidents less than $1\frac{1}{2}$ per cent of time worked.....	25

Shift bosses shall receive one-half the above bonus for the same records.

The calendar month is the bonus period. If a fatal accident occurs, all foremen and the shift boss on duty lose bonus for the month.

3. A bonus of \$25 to each shift boss working 1,000 man-shifts without a serious‡ accident and no lost-time† accidents, graduated down to \$7.50 for no serious and not over three lost-time accidents. After a serious accident to one of his men, the shift boss must work 500 man-shifts before starting on bonus period again. For preventing the report of an accident the shift boss shall be penalized 1,000 shifts for the first offense and debarred from bonus for a second offense.

4. A bonus of \$10 shall be paid to each shift boss working 750 shifts without a serious‡ accident. Five dollars per month shall be paid each "jigger boss" in charge of 10 or more men who works the month without a serious accident.

These four plans represent the extremes of the conditions that are required before the bonus is earned. Under each plan the bonus is earned at frequent intervals, which is one of the requisites of its success. If the conditions are so severe that they cannot be met by a sincere effort on the part of the bosses, the bonus will not have the desired effect. The "safety bonus" has resulted in a reduction in the cost of inspection by the safety department.

†A serious accident is one causing disability for 14 or more days.

The Republic Iron & Steel Company, Youngstown, Ohio, has completed the construction of a new continuous mill at its Bessemer plant, comprising a combination sheet bar, billet and skelp mill, steam-operated. It is planned to place the new unit in service at an early date. Work has also been finished on the installation of a new mixer for handling molten iron, about 800 tons capacity, situated between the blast furnaces and the steel mill. This expansion will practically complete the company's improvement program which has been in progress for a number of months past.

Homestead Entertains

Charles M. Schwab, chairman Bethlehem Steel Corporation, was guest of honor at a celebration under the auspices of the Homestead Chamber of Commerce at Homestead, Pa., on October 10. It will be recalled that in his early days Mr. Schwab was general superintendent of the Homestead Steel Works, in which capacity he played an important



MR. CHARLES M. SCHWAB

part in the early growth of the community. The celebration marked the growth of Homestead from a small mill town to a business, industrial and residential district with a population of almost 50,000, with industrially invested capital of more than \$41,000,000 and annual payrolls exceeding \$15,000,000.

New Ferro-Phosphorus Furnace

J. J. Gray, manufacturer of ferro-phosphorus, has contracted with Arthur G. McKee & Company, Cleveland, for the design and construction of a new blast furnace at his plant at Rockdale, Tenn. Although the manufacture of ferro-phosphorus is ordinarily confined to electric furnace or similar operation, Mr. Gray has, for some time past, produced this alloy in a blast furnace, under a patented process controlled by him. Operations, however, have been on a rather small scale, and it is now planned to materially increase production by dismantling the existing furnace and providing a complete new stack, approximately 70 ft. high with 12-ft. hearth. On account of the peculiar difficulties and hazards incident to the manufacture of ferro-phosphorus, the furnace will be provided with a specially constructed gas tight hearth and bosh, the hearth jacket being of cast iron with machined joints. The tuyere breast and bosh jacket will be very heavy, cooled by special means, and provided with heavy steel bands to insure against the escape of the phosphorus produced in the smelting operation.

The Gibb Instrument Company of Bay City, Michigan, manufacturers of electric welding machines and electric heating machines has broken ground for a new modern plant.

The Pay-Roll Dollar in Industry

The Vital Importance of the Human Element Compared with the Apparent Importance of Plant Equipment

By S. F. FANNON*

THE last 10 years has brought a vast change in the relations of man to man. It is not merely the fact that workmen are fewer, nor that employers are less independent — fundamental forces have been at work which no man nor set of men have the slightest power to change. Civilization has taught us that another's opinion of each of us individually is a matter of utmost importance; we can work happily and live comfortably only when we hold the good will of those about us, above us and below us, and to deal equitably with others we must certainly possess a feeling of confidence in their integrity.

We cannot hope to build a home, city or nation, and build it well, unless we first lay the foundation of

of application of good will in its most fundamental application—not toward our customers, but toward our employes, whose hands and brains make possible production in quality and quantity. Do you realize that because we have failed to develop, as industries all over the country, a feeling of good will between employer and employe that we are losing 25 per cent of every dollar that we are investing in the pay envelope, that industry is putting one dollar in the pay envelope from which it is receiving but 75 cents in return today? A 75-cent dollar in business! What a stupendous loss—a loss which at once creates an economic waste, that cannot help but affect employer, employe and the entire country.

Let us consider for a moment or two the various major factors found in industry. Take machinery. We have ever spent a large amount of time and money upon machinery, that from it we might receive the maximum return for every dollar invested. We have kept our inventors busy applying their genius toward the development of this factor, that we might secure a higher production and the largest possible return on every dollar invested in machinery.

Day and night we are working upon the problem of raw materials. We have created our own research departments that we might locate sources from which we might secure a constant supply of the proper qualities, and thus eliminate all losses in raw materials.

There is hardly a newspaper or periodical published today that does not contain an article on management. Highly developed courses on management are to be found in the curriculum of our larger universities. We are putting forth every possible effort in order that there may be no loss in the dollar invested in management.

The same can be said of merchandise and market. The matters of style, the elements of fashion, the question of seasonable goods, the various channels of distribution, and numerous other related phases are all under continual scrutiny, not only by individual manufacturers, but also by associations of manufacturers, in practically all lines today. We are maintaining experimental laboratories for the purpose of obtaining quality, decreasing cost, and developing new and additional uses of products, that we might secure the maximum return for the dollar invested in merchandise and market.

But when we come to the dollar invested in the human factor we find quite a different story. It does not seem possible that men who have shown such intelligence and foresight in handling the dollars invested in these other factors, would fail in many instances to provide against a loss in the dollar invested in men. There are a few employers who give intelligent and sympathetic consideration to the viewpoint of the workers. These employers are receiving a larger return for the money invested. Nevertheless, the truth remains that we are almost universally neglecting the dollar invested in the payroll envelope.



MR. S. F. FANNON

good will. Good will is the prime factor in business. We have erased from our blackboards the statement, "The public be damned," and we have written in its place, "The public be pleased," or "The customer is always right." I am certain that each and every one of us realizes that a certain part of our profits today are directly due to this principle of good will in business.

And yet with all the lessons we have had, with all that we are learning about good will, I wonder how many of us have ever stopped to realize just what we are suffering in this country because of the lack

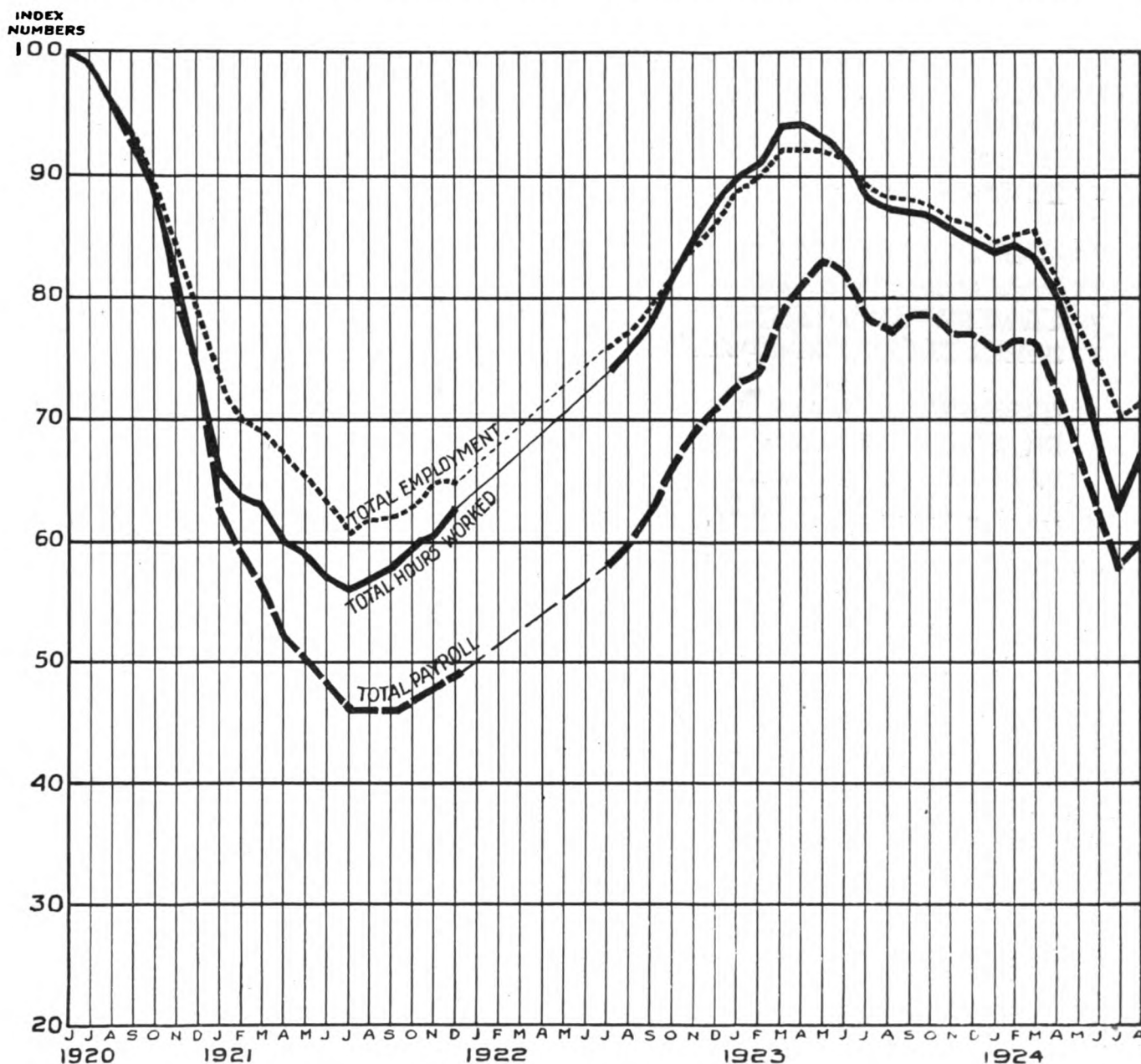
*Director, Department of Public Relations, Sherman Service, Inc., Boston, Mass.

Are we to admit that cash invested in plant and equipment exerts a more powerful appeal to the executive than cash invested in payroll? Is it possible that a machine made of iron and steel is more attractive to the executive than a machine made of flesh and blood? Man-power is vitally essential to machine-power and to the profitable operation of any industry. All factors found in industry and business depend upon the loyal support, intelligent co-operation, and harmonious production by the human element.

Nevertheless, mechanical factors commonly receive 95 per cent of the executive's attention, and the

crumbs of 5 per cent are thrown to the human factor. In many plants at this moment engineering specialists are engaged in studying and improving conditions of equipment and process. This is as it should be—executive appreciation of science in machinery and processing adds to profit. But in how many plants will you find management sufficiently enlightened to realize that science in the human factor pays large dividends?

Why is it that we are paying 95 per cent attention to plant and equipment and only 5 per cent to men? One man said to me, "Mr. Fannon, I will tell you why.



It is a remarkable fact that in spite of an industrial depression of some severity, with very few exceptions, wage rates have maintained the high levels which were reached in the boom period of last year. This is true of the iron and steel industry, being due to increases in wage rates and to the adjustment of working hours of a large group of labor to an 8-hour day basis. Data compiled by the National Industrial Conference Board show that in the iron and steel industry the average hourly workers, both skilled and unskilled, there is an increase in the month of August over the month of August, 1923. In skilled workers, the increase in the index figure is as much as 24 points. The index number of wage earners employed fluctuated between 83.2, the high mark in March of this year, and 53.1 in July of this year, and for the month of August, there is again an increase over the month of July. It is worth noting also that computing the cost of living and wage rates from the same common basis of 100 in July, 1914, that the drop in the cost of living has been considerably greater than the drop in wages from the high peak, and that the purchasing power of the dollar is greater than it was. The average wage earner is, according to investigations made by the Board, 27 per cent better off than he was in July, 1924.

America is a business nation. Being a business nation, she thinks in dollars and cents. Thinking in dollars and cents, the executive quite naturally thinks of his largest investment, and his largest investment is in plant and equipment." Now this is a fallacy. Our largest investment is not in plant and equipment, but in the dollars and cents invested in the payroll envelope. In the average business cash invested in payroll will exceed cash invested in plant and equipment within two or three years; even the most unusual enterprise's payroll will exceed plant investment within five years.

Take for example your own plant. Figure its cost as compared to your annual payroll and you will find that there is not much difference between the

valuable machine simply because it isn't operating well. This antiquated practice is utterly hopeless of success because no system of spyism can do more than deal with symptoms, leaving the causes as firmly entrenched as ever.

Other employers have tried to secure improved results on payroll investment through the various activities known as welfare work. They tried to win the co-operation of their employes by giving them something. Labor does not want patronage—particularly when it assumes large proportions and lays itself open to criticism as undesired activities paid for involuntarily by the employes out of money taken from their pay envelopes.

Some employers think that wages alone control productive effort. This is unsound because thousands of workmen who are getting a large day's pay are delivering from 25 to 50 per cent less than a full day's work. It oftentimes turns out that the more the employer pays, the less the employee delivers. This fact may well furnish food for thought to employers who are increasing wages in the hope of increasing production.

Other employers think that vocational skill controls productive effort. There are, however, countless employees who are vocationally fit, but who are delivering from 25 to 50 per cent less than a full day's work. Some of the shortest producers are well trained men in their vocations.

Intelligent analysis has proved that the factor which controls the productive effort of every workman is his "motive." If a man kills another man, the law recognizes that motive controls action and the state will ascertain the motive for the act. But aside from acts governed by law the existence and power of motive has been little understood.

In industry, the motives of workmen exert a tremendous influence for or against productive effort, and are thus the root of vast losses on payroll investment. And yet employers pay little or no attention to the motives of employees.

In various plants considerable attention is given to motion-study, but not to motive-study, although the motions of the workmen are controlled by their motives. Sherman Service has established the fact that every working force is made up of three types of employees, irrespective of the size of the plant, kind of product, open or closed shop, or any other condition. Not three types of employees by sex, creed, vocation or rate of pay, but three types as regards motives: Conservative, Radical and Neutral.

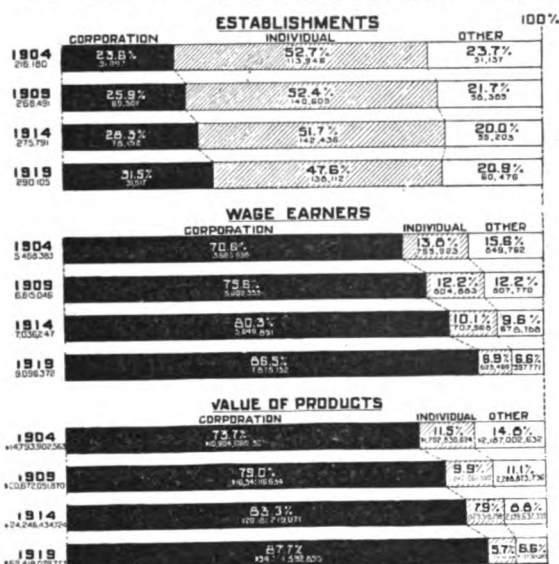
The proportions vary somewhat from one plant to another, but we have established through our analysis that in 100 typical employees, 10 per cent are of conservative motive, 10 per cent of radical motive, and 80 per cent of neutral motive.

The 10 employees of conservative motive produce a full day's work. There is no loss on their payroll dollar.

But the 10 employees of radical motive produce only 50 per cent of a full days' work. There is a loss of 50 per cent on their payroll dollar.

And the 80 employees of neutral motive produce only 75 per cent of a full days' work. There is a loss of 25 per cent on their payroll dollar.

The net result in this case, which is typical, is a loss in production value of 25 per cent of payroll investment per 100 employees.



Analysis of the relations shown by the charted totals above brings to light many significant facts. In 1904 there were 3,860,000 wage earners employed by corporations, and their average annual product equaled only \$2,800 apiece. Fifteen years later, in 1919, the number of corporation wage earners had increased to 7,875,000, while their average annual production had jumped to \$7,000 apiece. Mechanical equipment designed to speed up production must be credited with most of this increase, as comparisons made in trades where no such equipment has been introduced show marked reduction in output. Assuming the 75c dollar in payroll it is evident that these manufacturing industries suffered an actual loss in 1919 of nearly five billions of dollars.

two—the amortization of your plant is probably on a 20-year basis—your payroll is paid every year.

And yet how we safeguard the investment in plant and equipment! He would be a foolish man who would allow his plant to go a single night without proper insurance. But how many plants today have a protection on the larger investment, that of the payroll envelope? Necessary? Absolutely! Our industrial fire losses have averaged two hundred million dollars yearly—strife losses have equalled two billion dollars—a risk and waste ten times as great as that of fire—and though it has been tried, no insurance company has as yet been able to withstand the losses in the writing of strife insurance policies. And what is the cause of strife but the lack of good will and common understanding?

Many employers have tried to secure improved returns on payroll investment by placing industrial spies in the plant to report delinquent employees so that they may be discharged. It is no more sound to fire the average delinquent workman than it is to scrap a

An employe of conservative motive is a 100 per cent producer for the reason that he believes that it pays to apply himself loyally and diligently, and to give his employer as much as possible. His daily production reflects satisfaction, co-operation and active interest-in-the-job.

An employe of radical motive is a 50 per cent producer for the reason that he believes that it pays to restrict his efforts and to give the employer as little as possible. His daily production reflects discontent, antagonism and extremely active hatred-of-the-job.

An employe of neutral motive is a 75 per cent producer for the reason that he believes that it pays to produce just enough to hold his job. His daily production reflects indifference, non-initiative, and lack of interest-in-the-job.

Thus we have a loss of 25 per cent in production due to incorrect motives of the employes. Correct this motive and we salvage some part at least of this 25 per cent loss which is at once placed on the profit side of the ledger.

Just consider for a moment or two the cash value of these motives. Take these 100 men at \$4.00 per day, and we are putting in the pay envelope each year \$120,000, out of which, as we have just seen, we are losing \$30,000. Twenty-five per cent loss in the payroll isn't very much after all, that is, it isn't very hard to lose. It is only 12 cents an hour on a \$4.00 wage; but don't forget this, there is an octopus with 10 great arms reaching out after that 12 cents an hour loss—absenteeism, labor turnover, waste of time, waste of materials, waste of tools, spoilage of machinery, waste of supervision, under production in quality and quantity, inefficient procedure, dissatisfaction, reducing the loss down to 1 2/10 cents an hour for each item.

You are asking, "Is there a remedy, and if so, of what does it consist?" Yes, there is a remedy, and that remedy is education. And, while it seems a simple word, it is not as simple in its application as it seems to you at this time. I don't mean by education that you are to put seats in a certain room of your factory and then call in your employes and give them certain lessons like in a primary class. Not an education that comes from the executive down, but an education that comes from the men to the men in their own language, the very kind of an education that you give the customer when you call on him. You must place yourself on the customer's level and talk his language, that is the way that education must be applied to the employe.

As a result of 14 years of practical experience in industrial co-ordination, we have learned that in the solution of this problem everything depends upon the sincerity and spirit with which you approach it. The method of education is no less important.

Bear in mind that there has already developed a gulf between management and employes, and any outward move by management would likely be viewed with suspicion and distrust. Some one would raise the cry, "What's up the boss's sleeve?" "What's he trying to put over on us now?" Again, any stereotyped method of education cannot wholly accomplish the purpose, since it fails to deal with existing pertinent factors, and if the message should be paradoxical with the grievous existing condition, it is likely to do much harm.

Finally, any direct means "handed down" by management cannot prove effective until the barrier of mistrust now existing has been torn down and a constructive foundation of common understanding, sympathy and appreciation has been built up in its stead. For it is a scientific fact that the same causes will produce the same results.

The remedy, nevertheless, as I have stated before, lies in education, but in order that this may be intelligently applied, there must first be a correct understanding by management of the viewpoint of the employe as to the working conditions, wages, supervision, facilities and environment. This analysis can be made by skilled man engineers without in any way disturbing the policy of administration, but careful procedure is necessary in order that this viewpoint will be free of bias and prejudice.

Second, such conditions as are found to exist which present cause for real grievance and which are correctable should be removed.

Then a systematic well-prepared organized campaign of education should be launched, based on careful study. This education should deal with the advantages of our form of government, our industrial system, opportunities for learning and for commercial progress and happiness, and a correct understanding of simple economics so that he may appreciate the many beneficial possibilities afforded him.

The employe should and could be made to understand why the pyramiding of wages without a consistent increase in production is fundamentally unsound and must ultimately react to his own disadvantage, since labor consumes from 80 to 85 per cent of all that is produced.

Your workers can be made to realize that it is the purchase power of the dollar, not the dollar itself, that is the determining factor of their gain. And of equal importance, they could and should be acquainted with the many advantages of "stick-to-it-ive-ness" on the job—of the particularly favorable and attractive conditions of the plant in which they are employed, and especially of how it will benefit them most if they serve their employer best and give him their maximum co-operation. They should be disillusioned from such fancied grievances as they may bear—and their negative thoughts should be supplanted by sound understanding of the rebounding gains to them by observance of fundamentals of good will.

If the workman can be influenced to actions which react to his own loss and disadvantage, he can be molded constructively. But this education must be conducted on a practical basis and in a manner which the employe will be receptive to, will understand and will believe.

By fostering co-operation rather than competition between management and wage earner, a real worth while, work-together spirit can be established with substantial gains to both the employer and the employe. All this can be done and is being done where there is proper application and the results are most gratifying.

Mr. Howard J. Witman, 632 Nasby Building, Toledo, Ohio, has been appointed district representative of the Kuhlman Electric Company of Bay City, Michigan. Mr. Wittman will have Northwestern Ohio as his territory.

Chromium—Its Uses and Its Alloys

An Important Effect of Chromium in Steel is Marked Lessening
of Thermal Conductivity—This Property Is of Importance
When Heat Treating Large Forgings

By DR. WALTER M. MITCHELL*

PART III

THE retarding effect of chromium is of considerable importance when heat treating large forgings, etc. Ordinary carbon steel if suddenly quenched in water will become very hard, but if cooled more slowly will be quite soft. Hence the difficulty of hardening massive pieces of such material because of the impossibility of securing sufficiently rapid cooling in the interior. The addition of a small percentage of chromium will so retard the rate at which the interior metal softens, that this "mass effect" is greatly reduced. Consequently such steels are called "deep hardening." With greater chromium content the solid solution will become so stable that quenching is not necessary to produce hardness, the steel becoming hard when merely cooled in air, and steels of this character are known as "self hardening" or "air hardening."

An important effect of chromium in steel, which undoubtedly is the cause of some of the phenomena just described, is the marked lessening of thermal conductivity imparted by its presence. For instance, "stainless steel" (13 per cent chromium) in the hardened condition, where the maximum chromium is in solution, will have a thermal conductivity less than one-fourth that of pure iron; in the annealed condition, where some of the chromium has been precipitated in the form of carbides, the thermal conductivity is about one-third that of pure iron—the effect of chromium in solution being clearly shown. Hence any heat transfer to the interior of a given piece of steel, which is necessarily antecedent to atomic changes, will take place very much more slowly than in straight carbon steel, and high chromium steels must therefore be heated more slowly and carefully; preheating, as with high speed steel, being practically essential.

Unlike nickel which, when present even in small proportions, combines with the iron to form a solid solution, chromium combines with the carbon, forming a series of extremely stable carbides, only going into solid solution with the iron when present in excess of the proportion demanded by the carbon for the formation of such carbides. If chromium is present in such excess, the solubility of the iron for carbon is thereby reduced, and the saturation point, or rather the eutectoid ratio, of carbon in iron is lowered. Monypenny† has investigated this and finds that the eutectoid ratio is lowered for various chromium contents as follows:

Chromium	Carbon
0 per cent	.89 per cent
2	.65
4	.55
8	.42
12	.32

*The author is Metallurgist with E. I. du Pont de Nemours & Company, Wilmington, Del.

†Journal Iron and Steel Inst. 1920 I, 493.

From this is evident the increasing effect of carbon in conferring hardening ability in high chromium steels in comparison to steels that are free from chromium. For example, from the structural standpoint, an annealed steel containing 12 per cent chromium and .05 per cent carbon corresponds to a tool steel containing 1.3 to 1.5 per cent carbon.

Owing to lack of definite knowledge of the physical chemistry of the iron-chromium-carbon system it is difficult to state the manner of formation of the

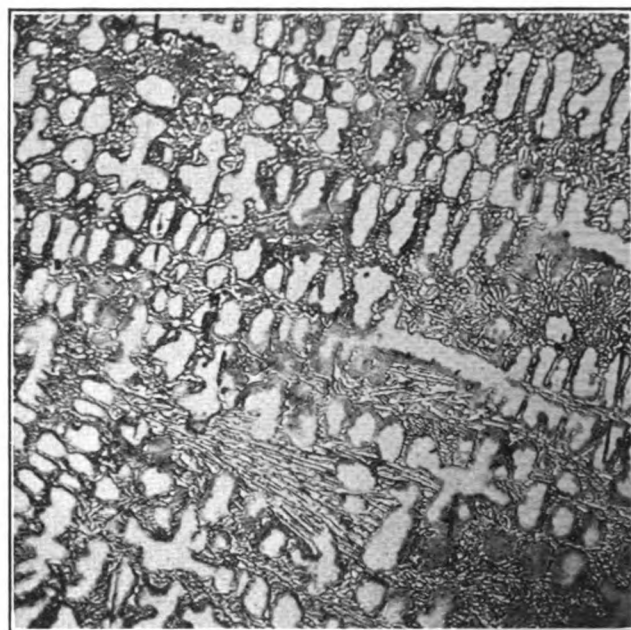


FIG. 8—Low Carbon high chromium iron alloy.
150X. Picric Acid. (Reduced ¼.)

chromium carbides or their exact composition. Edwards, Sutton, and Oishi† state that alloys, where the ratio of chromium to carbon content is less than about 10-1, will show little or no greater facility to harden on cooling from either high or low initial temperature than ordinary carbon steels, but alloys in which this ratio is exceeded harden much more readily, i. e., their critical cooling velocities are substantially slower than carbon steels of similar carbon content, and they become in the "deep" or "self" hardening class. This applies only to the ternary chromium steels; in quaternary and higher steels the value of this ratio, which is at best uncertain, will be altered.

With the ratio of chromium to carbon content up to 4.3, chromium forms the carbide Cr_3C_2 , which combines with cementite to form the double carbide $\text{Fe}_3\text{C} \cdot \text{Cr}_3\text{C}_2$, the chromium and carbon contents of which are 4.3 per cent and 10 per cent, respectively.

†Journal Iron and Steel Inst. 1920-I, 403.

With annealed steels, containing less chromium than is necessary for the formation of this carbide, practically none of the chromium will be present in solid solution with the iron. If, however, chromium in excess of that required to form this compound is present, it seems probable that the nature of the carbides will change, as chromium is increased beyond the 4.3 ratio, and a second or higher carbide will be formed, the composition of which is doubtful, possibly Cr_5C_2 or Cr_4C , which will also combine with cementite, forming another double carbide.

The temperatures at which the carbides separate from solution during cooling are raised by an increase in chromium and carbon content of the steel. In considering any particular series of alloys in which the carbon is constant, or in which the chromium is constant, the same authors found that the separation of the carbides occurred at the highest temperature when the proportion of chromium was approximately 10 times that of carbon; and that the temperature of the thermal change increased as the chromium and carbon content increased along a line in the ternary diagram corresponding with alloys containing 10 times as much chromium as carbon. Upon this evidence the authors base their plea for Cr_5C_2 as the composition of the higher carbide.

Arnold and Read† prepared a series of alloys containing approximately .85 per cent carbon with chromium varying from .65 per cent to nearly 24 per cent, which were carefully annealed to precipitate the carbides and then electrolytically decomposed. From analyses of the residues thus obtained, these authors



FIG. 9—Low carbon high chromium iron alloy.. 150 $\times$. Etched with boiling alkaline potassium permanganate (carbides darkened). (Reduced $\frac{3}{4}$.)

concluded that the carbides found corresponded with the compositions Cr_3C_2 and Cr_4C , both occurring combined with cementite to form double carbides, the proportion of the Cr_4C compound increasing with carbon content and thus changing the general nature of the higher double carbides.

†Journal Iron and Steel Inst. 1911 I.

A somewhat similar line of thought was reached by MacQuigg§ after investigating alloys of 20 per cent chromium and upwards. In alloys of this composition with low carbon, less than .20 per cent, chromium was present in solid solution with the iron, and there were no free carbides discernible. These alloys

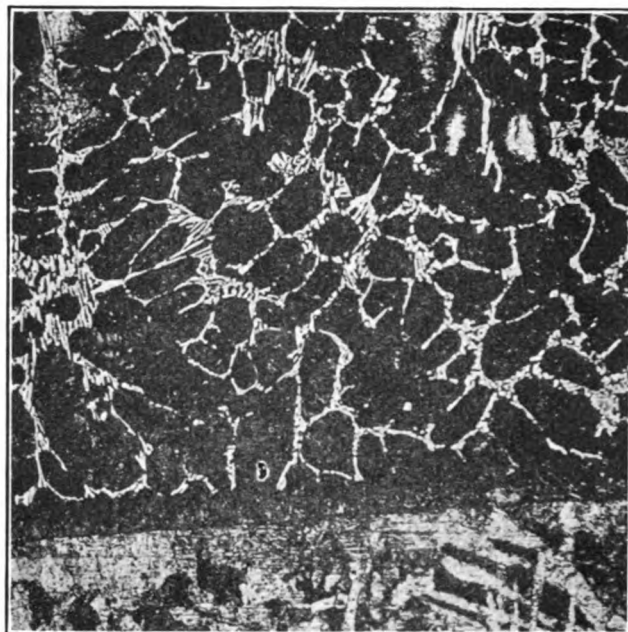


FIG. 10—Low carbon high chromium iron alloy. Etched with boiling 1-1 HCl (solid solution darkened). 150 $\times$. (Reduced $\frac{3}{4}$.)

were soft, although harder than the corresponding carbon steels, and could not be hardened by quenching.¶ Increase of carbon to .46 per cent with 22 per cent chromium showed carbides present in the form of small white particles in a matrix of solid solution, the carbides being very stable and not absorbed by heating, or at least only to a minor extent. Such low carbon alloys were readily forgeable and rollable, but because of their greater hardness required a higher low limit of temperature for hot working than plain carbon steels. With further increase in carbon content, the relative proportions of the iron chromium solid solution decreased while the carbides began to appear in network formation, increasing to lace-like patches with a eutectoid structure (similar to the low carbon ferrochromes). With higher proportions of carbon the solid solution assumes the form of dendrites (Figs. 8-10) in a eutectoid matrix, presumably of carbides and solid solution. With a 2.75 per cent carbon in a 27 per cent chromium alloy the free solid solution disappeared, the whole material assuming a eutectoid structure somewhat similar to pearlite in carbon steel. Further, the physical properties were analogous, combining great hardness and toughness. On still increasing the carbon content to 3 per cent, a

§Forging-Stamping-Heat Treating, Jan., Feb., 1924.

¶There has been considerable discussion over the hardening ability of the very low carbon iron-chromium alloys. Due to the greater hardness characteristic of solid solutions as compared to pure metals, and the retarding action of chromium on grain growth, it is but natural that these alloys should be harder than the corresponding low carbon steel. But it is doubtful if these alloys can be considered as hardened by quenching in the same sense that carbon steels are hardened.

new constituent appeared, as with hypereutectoid carbon steel, in the shape of structurally free carbides occurring as needles and the characteristic "coffin" shaped crystals. (Figs. 11 and 12.)

Thus the range of 20-25 per cent chromium steels, similar to the higher percentage of ferrochromium alloys, gives rise, with varying carbon content, to a

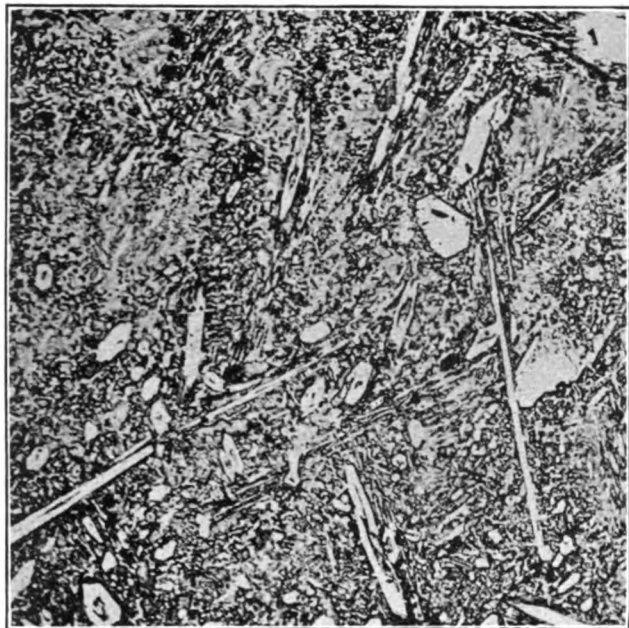


FIG. 11—High carbon high chromium iron alloy (hypereutectoid). 150 $\times$. Etched with Le Chatelier's reagent. (Reduced $\frac{1}{4}$.)

range of alloys structurally analogous to the straight carbon steels. These vary from the iron-chromium solid solution as the chief constituent with very low carbon, through the hypoeutectoid, eutectoid, and hypereutectoid stages, as the carbon increases; the solid solution taking the place of the ferrite, and the carbides the place of cementite. The dividing line, which corresponds to the eutectoid ratio, being apparently the 10-1 chromium-carbon ratio of Edwards. From the action of the etching reagents, MacQuigg concluded that the composition of the carbides in these alloys varied with increasing carbon content. That this is evidently the case may be inferred from the appearance of the free carbides which, in the hypoeutectoid alloys, appear as rounded non-crystalline forms, while in the hypereutectoid alloys the carbides assume the needle and coffin shaped outline which is generally found in high carbon ferrochromium alloys. Both of these forms are altered very slowly on heating, the rounded carbides apparently being much more stable than those in crystalline form.

In view of the great industrial possibilities of the higher chromium steels, because of their abrasion and corrosion resisting qualities, further research is desirable to determine the chromium-carbon ratio which divides the alloys with free solid solution, which will have the greatest resistance to chemical attack, from those which, because of the free carbides, possess greater hardness and abrasion resistance. Edwards, as mentioned, has given this ratio as 10-1, and the investigations of MacQuigg have confirmed this in a measure. But it is doubtful if this ratio will hold constant for the high chromium alloys, such as the

ferrochromes. With these it appears to be more nearly 20-1 as the dividing line. Such investigations may also determine whether the generation of the higher carbides gives rise to the self hardening properties of the hypereutectoid chromium steels.

Due to the retarding action of chromium upon atomic and molecular migrations the rate of cooling has a marked effect upon the temperatures of the critical transformations. The higher the initial temperature above the A_{c1} point, the lower the temperature at which the transformations take place with rapid cooling. Apparently the more complete the chemical union which forms the carbide at the high temperature the greater its stability; or perhaps, the type of carbide formed at the high temperature is more stable. Thus, those transformations in chromium steels which are depressed by normal cooling will be still further depressed, or may take place so slowly as to be entirely suppressed, with more rapid cooling.

The general effect of chromium, neglecting for the moment the manner in which the critical transformations are affected by variations in the rate of cooling, is the raising of the temperatures of the critical ranges. Scott* finds that the A_1 range is raised progressively up to about 8 per cent chromium, after which it remains without change; A_{c1} being raised more than A_{r1} , the lag between these ranges being thus increased. The carbide constituent of the pearlite in annealed or tempered steels does not dissolve

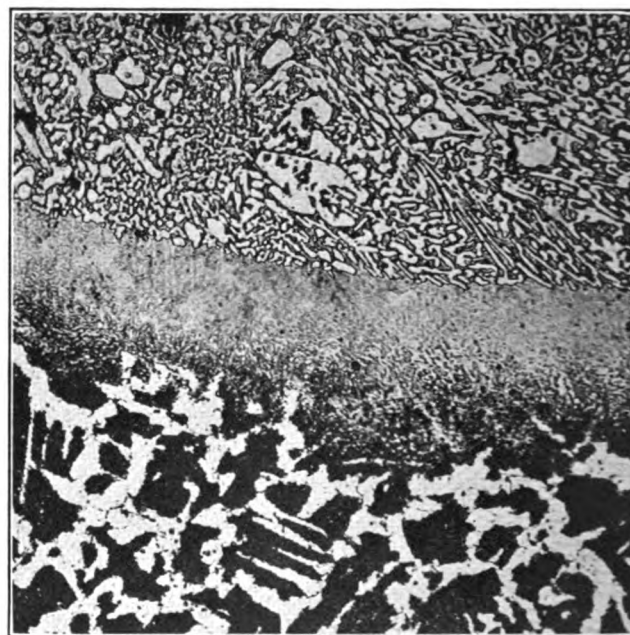


FIG. 12—High carbon high chromium iron alloy cast on surface of carburizing pot. This pot has seen 2400 hours service, the lack of change in carbide crystals and lack of diffusion of chromium coating (above) into steel of pot (below) is to be noted. 150 $\times$. Picric acid. (Reduced $\frac{1}{4}$.)

at A_{c1} on heating, but only commences to dissolve at that point, solution proceeding progressively with increase of temperature. As the rate of diffusion of the carbide is much slower than in carbon steels, much longer soaking is necessary in chromium steels to produce equilibrium conditions at a given tempera-

*Chemical and Metallurgical Engineering, 28, 212.

ture—in which connection the effect of the decreased thermal conductivity must also be considered.

Scott found further that the A_2 range was affected differently from the A_1 range. At about 3 per cent chromium A_2 falls below Ac_1 , and at 13 per cent falls below Ar_1 . When Ac_2 falls below Ac_1 , the latter change is not detectable by the usual magnetic meth-



FIG. 13—High carbon chromium iron alloy under oblique illumination showing relief structure of carbides. 150 $\times$. Not etched.

ods, and this means of determining the correct hardening temperatures is valueless.

In the lowering, or complete suppression, of the Ar_1 transformation with sufficient chromium content, doubtless because of the slowness with which the carbide is precipitated from solution, we have the cause of the important quality of "self hardening," which will be further discussed in connection with high speed steels. Chromium steels having normal transformation points become pearlitic or sorbitic on slow cooling, much the same as straight carbon steels. If the chromium content is such that the transformations are lowered by rapid cooling, the steels are martensitic or troostitic; when, with still higher chromium, the transformations are suppressed the steels are austenitic. The latter steels, owing to the relatively larger proportion of chromium and carbon held in solution at high temperatures may precipitate this more readily as a finely divided carbide. Hence, on tempering, these steels do not become martensitic, but pass directly into a troostitic constituent, assuming with Bain and Jeffries that troostite consists of finely divided particles of carbide dispersed through a solid solution. The coalescence of the carbide particles, once they are thrown out of solution, into particles large enough to be seen by the eye or to affect the physical properties, takes place much more slowly. With the very high chromium and carbon alloys, such as were studied by MacQuigg, the proportion of carbides is so large and these are so stable that they are practically insoluble short of the molten state. These alloys do not show the customary constituents, martensite, troostite, sorbite, etc., and show very little change from the cast condition with any heat treatment, excepting a slight rounding of crystal corners,

even under prolonged periods of heating. (Figs. 12 and 13.)

The tendency of chromium is to raise the A_2 range; that is, the temperature at which the carbides will have the maximum solubility in the solid solution. This has been clearly shown by Bain* in experiments on a series of alloys varying from 1.4 to 15.6 per cent chromium. The temperature of quenching which confers maximum hardness varied from 1500 deg. F., with the lowest chromium content, to 1900 deg. F. for the steel with highest chromium; which explains the familiar fact of the necessity of exceeding by some 300 deg. or 400 deg. the normal hardening temperature of plain carbon steels, in order to produce hardness in steels of the "stainless" type.

*Transactions A. S. S. T. 5 89.

Apprentices Attend Carnegie Tech Classes

Continuing the co-operative plan effective a year ago between the Sheet Metal Contractors' Association of Pittsburgh and Local Union No. 12 of the Amalgamated Sheet Metal Workers' International Alliance, approximately 65 sheet metal apprentices will attend classes one day a week during the coming year at Carnegie Institute of Technology, in Pittsburgh, according to a report from the Institute authorities. For the coming year, also, it is reported, the employers have again agreed to pay the apprentices their full day's wages while they are attending classes, and the union officials will again assume the responsibility of compelling the apprentices to attend the classes.

In addition to the continuation of the sheet metal apprenticeship agreement, a somewhat similar plan concerning the training of apprentices of the local union of the International Wood, Wire and Sheet Metal Lathers at Carnegie Tech, will be in effect again this year. Although this second co-operative plan is considerably different from the sheet metal apprenticeship agreement in its details of operation, it is similar in its significance because it reflects the changing attitude of labor unions toward the training of apprentices. Under the plan made a year ago between the Institute and the local union of the metal lathers, about 15 metal lathers apprentices will again take night courses three nights a week during the current year it is announced.

While both of these developments are unique, officials of Carnegie Tech and others interested in apprentice training consider them as indicative of a growing tendency among labor union officials and the so-called capitalist interests to co-operate toward the solution of the apprenticeship problem. Pittsburgh now holds the distinction of being one of the first cities in the country to take definite steps in the training of apprentices by organized labor, employers, and educational interests into a common cause.

Since the time a year ago when the effecting of these two agreements at Carnegie Tech were announced, inquiries have been received, it is reported at Carnegie Tech, from cities throughout the country regarding the methods used in promoting and developing such plans. According to Dr. C. B. Connelley, Director of Industrial Relations, who has fathered the

(Continued on page 518)

SHEET AND TIN PLATE

Sheet Steel Simplification

Unanimous Ratification of Committee's Schedule at Atlantic City Conference

At a meeting at Middletown, Ohio, on Tuesday, September 9th, the Sheet Steel Simplification Committee, headed by Walter C. Carroll, chairman, received either the endorsements of the schedule as submitted to the sheet steel manufacturers early in July or their criticisms with suggestions as to additions or further eliminations, from every sheet manufacturer. In other words, the report made at the meeting represented 100 per cent of the industry. A total of 11 additional items were recommended by two mills, and a further elimination of a total of 22 items was suggested by two other mills. Taking these changes into considera-

Manufacturers, the metal branch of the National Hardware Association, National Association of Sheet Metal Contractors, both of which organizations also held meetings in Atlantic City simultaneously, the jobbing manufacturers, the federal specifications board, the American Engineering Standards committee, the United States Chamber of Commerce and the Government Bureau of Standards, was appointed. This committee will endeavor to iron out such inconsistencies, objections, and mistakes as may appear in further study of the simplified sheet schedule.

This committee will report back to the metal branch of the National Hardware Association at its annual convention to be held next June.

Following the sheet steel meeting, the producers of plain round conductor pipe agreed to eliminate the manufacture of 2½ and 3½ inch sizes and eaves trough in the 3 and 4½ in. sizes, and elbows in the No. 0 angle. In addition, a resolution unanimously was adopted to the effect that no eaves trough, conductor pipe, elbows, shoes, mitres and accessories, including gutters, valleys and ridge rolls, will be made lighter than 28 gage full weight, eliminating 27 gage entirely.

The association, its committee chairman, Mr. Carroll, and Mr. Hoover's organization, are jointly to be congratulated on the expeditions and effective work which over a period of comparatively few months has resulted in this fine co-operative effort.



MR. WALTER C. CARROLL

tion, the final simplification schedule will show 261 items, or a reduction from 1819 items of 85.6 per cent.

Following this preliminary endorsement, a conference held at the Marlborough-Blenheim in Atlantic City, October 14, unanimously adopted the proposals with but slight exception. The original proposals were amended to include 18 gauge one-pass cold rolled box annealed 36x96 in., and 14 gauge blue annealed 24x96 in.

The question of eliminating all gauges lighter than 28 full weight galvanized and painted roofing met with considerable discussion, but was finally adopted.

The schedule as shown on page 509 will be placed in operation beginning January 1, 1925.

A committee composed of one representative each from the National Association of Sheet and Tin Plate

SIMPLIFIED PRACTICE*

Just What This Term Implies Is Explained, Together With the Method of Procedure.

ANY of our industries — many more of our businesses — believe that we are suffering from too great variety in almost every article of commerce in this country. Leading men in widely different fields agree that the reduction of variety, the simplifying of industrial and commercial practice in any line, will secure some or all of these advantages:

Simplified practice will decrease:

Stocks.

Production costs.

Selling expenses.

Misunderstandings.

All costs to user (including initial accessory and maintenance costs).

*Department of Commerce, Washington, D. C.

SIMPLIFICATION OF SIZES FOR STEEL SHEETS PROPOSED BY SIMPLIFICATION COMMITTEE

Gauge	GALVANIZED FLAT SHEETS											
	12	14	16	18	20	22	24	26	28	29	30	
12												
14												
16												
18												
20												
22												
24												
26												
28												
29												
30												

ONE PASS COLD ROLLED BOX ANNEALED SHEETS

16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

BLUE ANNEALED SHEETS

8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

CORRUGATED ROOFING AND SIDING

GALVANIZED—Present standard widths and corrugations—In even foot lengths 5 ft. 0 in. to 12 ft. 0 in. in 29 gauge and heavier, EVEN GAUGES.
PAINTED— Present standard widths and corrugations—In even foot lengths 5 ft. 0 in. to 12 ft. 0 in. in 28 gauge and heavier, EVEN GAUGES.

ROOFING—(All other Styles and Patterns)

GALVANIZED—Present standard styles and patterns in 29 gauge and heavier, EVEN GAUGES.
PAINTED— Present standard styles and patterns in 28 gauge and heavier, EVEN GAUGES.

*Two sheet mills recommend item thus marked be eliminated. (Total, 22 items.)
†Two other sheet mills recommend items thus marked be added. (Total, 13 items.)

Simultaneously, simplified practice will increase:

- Turnover.
- Stability of employment.
- Promptness of delivery.
- Foreign commerce.
- Quality of product.
- Profit to producer, distributor and user.

Frequently a manufacturer, or group of manufacturers, would like to eliminate excess varieties, but feels that the producers cannot properly approach either the distributors or the users of these articles with such a proposal. In other lines it is the distributors who would like to bring about reduction of variety if they could get the manufacturers and users to agree, while in still others, it is the user who would most appreciate fewer kinds.

Secretary Hoover has established the Division of Simplified Practice to serve as a centralizing agency in bringing producers, distributors and users together and to support the recommendations of these interests when they shall mutually agree upon simplifications of benefit to all concerned. Any group in any branch—production, distribution or use—can secure the services of the division upon request.

These services are:

1. Talks to trade associations, or other organizations interested, showing the results achieved in similar fields through reduction of variety. These talks are illustrated by lantern slides and are modified wherever possible to apply particularly to the immediate field of interest.

2. Authorization of a trade association secretary, or other competent man chosen by the industry concerned, to act as Secretary Hoover's representative in making a preliminary survey which shall summarize the facts of present practice. The sort of data to be obtained in such a survey is outlined in accompanying "Suggestions for Surveys of Varieties and Types." Experience shows that this authorization from the Department greatly strengthens the surveyor in his appeal to all producers.

3. Arrangement of general conference of the Department of Commerce in Washington, or other central point, to which all producers, distributors, users, and general interests are invited for discussion of the report based on the survey and for recommendation of simplifications.

4. Publication of the recommendations of the general conference backed by the moral prestige of the department, giving full credit to all the representatives at the conference.

5. Request to each individual producer and distributor for formal acceptance of the recommendation as his standard of practice.

6. Follow-up request, after reasonable interval, for statement from each concern accepting under (5) showing percentage of production or consumption which conforms to recommendation and reasons for departure from its provision. (This data to be used in guiding conferences called to revise the recommendation at proper intervals, thereby preventing any paralysis of invention and development.)

7. Arrangement of revising conferences at periods agreed upon by the industry.

In all of this service it will be noted the division is concerned solely with finding and supporting the best thought and practice of the interested industry. In no way does it make pretense of technical knowledge.

In no way does it attempt to determine, or even suggest, simplifications which the industry should adopt. Its sole function is to bring together all interests and to support such action as these interests may mutually agree upon.

Some seventy groups are already using this service in working out definite simplified practice recommendations, and each week new projects are added.

In some lines the conferences may decide that to obtain the full benefit of simplification, standard specifications or other standards of practice must be developed. If the industry does not have proper laboratory facilities or engineering talent within its organization, the division can arrange for the services of the National Bureau of Standards, in research, and those of the American Engineering Standards Committee, in development of technical standards. In such instances the bureau or the standards committee, will proceed under the direction of a committee of the conference and will report back to a subsequent conference. The adoption of the specification or other standard by this second conference must precede its support by the Department of Commerce.

Simplified practice may thus take any form which the industry or business believes will be of service in reducing the tremendous wastes now incident to excess variety in shape, size, quality, process, composition, or any other characteristic of product. Whatever the form developed, the Department stands ready to support all such simplifications of practice as will eliminate waste, stabilize business or extend our national commerce.

BOOK NOTE

There has not been published in recent years any modern, comprehensive work dealing with the metallurgy of aluminum. The work by Dr. Joseph W. Richards on that subject, the third and last edition of which was published in 1896, has been out of print for many years.

The increasing use of aluminum and its alloys, the growing importance of the industry, and the need of a thorough and up-to-date work on aluminum metallurgy, have prompted the publication of an entirely new and authoritative volume dealing with that subject.

This new volume, "Metallurgy of Aluminum and Aluminum Alloys," has been prepared by Robert J. Anderson, the well-known metallurgical engineer and technical specialist on aluminum, who was formerly in charge of the aluminum investigations of the U. S. Bureau of Mines, and whose experience covers many years in all branches of the industry.

The new work will be a complete and thorough presentation of the metallurgy of aluminum covering the subject fully from the mining of bauxite to the uses and applications of the metal and its alloys. While it has been more the purpose of the author to produce a practical work, the theoretical aspects have not been neglected, and the book will be found of great help not only to metallurgical engineers and foundrymen, but also to automotive and mechanical engineers, and others interested in specific applications of the metal and its alloys.

The book will contain over 800 octavo pages and 297 illustrations, and will be ready about December 15. The price will be \$10 net. H. C. Baird & Company, New York City, are the publishers.

CURRENT REVIEW

The Dawes Plan and German Industries

While these lines were being written, the London Conference was in session. The attempts to get together and stay together in harmony over the Dawes plan are evidently gaining steadily in earnestness and sincerity and while the voices of reaction are loud and critical, the logic of events seems to be shaping the situation in such a way that the only solution of a chaotic and dangerous problem will be effected on a basis of fairness, mutual compromise and good will. Germany has awaited the outcome of the conference with a heavy heart inasmuch as the basis for Germany's national and economic development is to be determined for many years to come.

Fear and hope are in the balance. Fear, that the way to Germany's political independence may not be cleared and hope, that with the inauguration of the Dawes plan a decided change in the development of Germany's economic life may take place.

General interest centers about the contemplated 800 million dollar loan, which is destined to not only provide the basis for the new German gold note bank, but which logically will act as a direct stimulus to business in general and thus help to remove the present money stringency. Furthermore, accumulated funds in America, seeking an outlet for investment, may then look to Germany for most promising opportunities.

The Dawes plan, being pivot and base of the entire structure to be erected, provides solely for the technical foundation of the financial structure of the reparations problem, a great success in itself which can not be overestimated. It should not be overlooked, however, that thereby the foundation only for actual work on the reparations and on the reconstruction has been safeguarded. The latter are not only problems of finance, but problems of production as far as Germany is concerned, a point which is deserving of widest attention and especially now during the period of transition.

Germany must prepare herself for increased production and on a price level which will coincide with the absorbing capacity of her domestic market and with the marketing conditions beyond her borders.

All hopes for revival of trade will be in vain as long as such revival is aimed at higher returns for industrial products than which correspond to the price level of foreign industrial products. Foreign credits to Germany can be of healthy effect only when a production is furthered which already has been placed on a normal and sound basis and with outlets ready at hand. In other words, German industries must once again be placed on a paying basis. It will not suffice that the technical foundation and equipment is made available for increased production, the products must be priced so that they can be sold.

So far, no efforts have been made in Germany to reduce prices of industrial products, neither for domestic use nor for exportation; on the contrary, indications point to a continuation of the methods which by circum-

stances were forced upon Germany during the last few years, meaning the effects of inflation and of economic isolation.

It must readily be admitted that great difficulties will have to be overcome in order to reestablish rational production, especially so in view of the outspoken lack of credit facilities. Circumstances, however, demand an early departure from present tendencies, so that Germany will be ready when the Dawes plan begins to operate.

Speaking of the burdens placed upon Germany in consequence of the reparation settlement, there seems to be the wide-spread opinion in the United States that the heavy reparation obligations will inevitably compel Germany to curtail internal consumption and force her to dump large quantities of exports as in 1922. In this respect we venture the opinion that Germany will be indeed fortunate if her production will be such as to enable her to export at all and to meet foreign competition. Furthermore, efforts will be directed toward exportation of quality goods rather than of mass and cheap goods. Quality products demand a certain price and can not be sold at bargain prices. Therefore, dumping will be out of the question.

Of much more serious nature is the present plan of the German government to return to the pre-war policy of agrarian protectionism. This would indeed be a deplorable development, inasmuch as an increased tariff on grain will not only increase the living costs of the industrial population, but will lead to higher wages, diminishing Germany's ability to compete in the world's markets, affecting her trade balance unfavorably and thus, no doubt, restrict her ability to meet reparations. It should not be forgotten, that, before the war, Germany was obliged to import grain to the value of three billion marks a year in order to provide bread for her population. Experience has shown that Germany, despite her protective tariff of 1902, was not able to produce the amount of bread needed for her population and that was before the war, when Germany's area was larger. It is clear that Germany's bread grows in her factories and mines which in 1913 have exported products valued at more than six billion marks in order to be able to import products from the United States, Russia and the rest of the world, which Germany herself can not supply and to pay for those raw materials which, turned into finished goods, were needed for exportation.

The realization of the Dawes plan will also necessitate the removal of the barriers which are in the way of facilitating German exports. This refers especially to the reduction of foreign customs tariffs. Such reduction has been advocated by various American economists who have pointed out the important role the American market, for instance, could play if a policy were adopted to aid in the restoration of Germany's trade balance, which, according to the Dawes plan, is a preliminary condition to German reparation payments.

—American Chamber of Commerce, Berlin.

Suspension Insulators

In order that electrical energy may be utilized at a distance from the point of generation, effective resistance must be offered to the escape of the current from the conductor. This resistance is provided by insulation, which takes many forms. For long-distance overland transmission, first for telegraphy, then for telephony, and later for power, bare wires have been supported on poles or towers. Between the wire and the pole or tower, an electrical barrier must be interposed of such shape and strength as to hold the wire securely against wind and sleet and other forces, while preventing flow of current from the wire. Almost everyone is familiar with the grooved glass caps screwed on the wooden pins on the arms of telegraph poles. It became necessary first to improve this type of insulator and then to devise others for the vastly larger currents of much higher voltage adopted for efficient transmission of power.

As rapidly as science and engineering could make advance possible, voltages for long-distance power transmission have been increased, from a few thousand in 1890 to 220,000 volts in 1923*. At one stage, about 1900, 60,000 volts was believed the absolute limit, but research discovered new laws and now 330,000 volts or more are a practical possibility.

Without development of line insulators this progress would have been impossible. Persons observant of power lines in recent years have seen insulators put on one and then more "petticoats" and change form in numerous ways. For high-tension (high-voltage) lines, insulators, in many systems, have been taken from the pins and suspended from the cross-arms. One insulator proving insufficient with increasing voltage, two to 15 or more have been hung in a string. Many other changes, not detectable by the passerby, have been important.

Development has been based largely on cut-and-try experimentation; but there have been also many instances of fundamental research. In one of these, Harold B. Smith sought to place the surface of the insulator under more favorable electrical conditions, to simplify the form of insulating surface for convenience in manufacture, to avoid corona prior to breakdown, to prevent arcing along the insulating surface, to reduce weight, length and cost, to raise the voltage per unit, and to eliminate porcelain, if possible. (Corona is a phenomenon of the escape of electricity from the conductor. It occurs with high voltages and causes loss.)

Principles and elements of design not previously used were introduced. Numerous models were tested at Worcester Polytechnic Institute and at the Pittsburgh plant of the Westinghouse Company. Early tests under favorable conditions to determine certain facts gave encouragement. Designs were then modified and tests made under conditions simulating bad weather. After experiments on many models, a type was found which would not break down, when dry, until a voltage of 280,000 or over was reached, and, when wet, would hold 200,000 volts or more.

One important new feature is the creation of a hollow electric "field" around the insulating member. (By a hollow electric "field" is meant one surrounded

symmetrically along its axis by a stronger field of higher average and maximum potential gradient.) To study the form of "field" for each model, shredded asbestos was used, making the lines of electrical flow visible and permitting them to be photographed.

The preferred experimental type is receiving service tests on transmission lines under various climatic conditions. It has three principal parts: a hood of sheet metal, in shape resembling an inverted hand-basin with very wide brim, a spindle of impregnated wood, and at the lower end of this spindle a torus (doughnut-shaped ring) of metal tube. Tentative dimensions are: overall length 30 to 40 inches; diameter of hood, 45 inches; diameter of torus, 17 inches over-all, and diameter of tube of which torus is made, 6 inches. The spindle is the insulating element. Satisfactory electrical and mechanical properties have been secured.

Not trusting eyes unaided to make sure that no corona or sparks were passing across the insulator models, polar high-speed stereoscopic photographs were taken, some of them at the rate of 520 per second. Neither streamer nor arc was detected along the insulating spindle, nor could be blown upon it by strong air currents.

Shapes and material of hood and torus resulted from efforts to distribute the electrical flux and to form a favorable electrical field around the spindle under all weather conditions, avoiding corona until the breakdown limit had almost been reached, and preventing arcing along the insulating surface.

It is expected that one of these insulators at each point of suspension will be sufficient on 110,000-volt power lines, that two will suffice for 220,000-volt lines, and three on 330,000-volt lines. This systematic research may prove epoch-making in insulation of power transmission lines.

Based on information supplied by Harold B. Smith, Fellow, American Institute of Electrical Engineers, Professor of Electrical Engineering, Worcester Polytechnic Institute, Worcester, Mass.

—Research Narratives.

Weekly Publications

Abandonment of the Pittsburgh base method of quoting prices by the U. S. Steel Corporation and independents has created considerable confusion in the steel market. Cleveland has been made a base on wire products equally with Pittsburgh, while shipments from three western mill points are put at a differential \$2 per ton higher and from New England, \$3 higher. For Chicago delivery \$3 over the Pittsburgh-Cleveland base is quoted. Base prices on wire are reduced \$1, resulting in the saving to Chicago territory of \$4.80 per ton and at Cleveland of \$3.

Cable advices from London show that the Germans are underselling the British producers in the English market on certain classes of steel and the British steel makers are considering a new pooling arrangement for buying raw materials.

An article by J. F. Curley gives tables showing the annual consumption of reinforcing steel by years since 1910.

G. R. Brandon, an industrial furnace engineer at Chicago, contributes an article on conserving industrial fuels.

*In 1896, electrical energy generated by the Niagara Falls Power Company was first transmitted 22 miles to Buffalo at 11,000 volts.

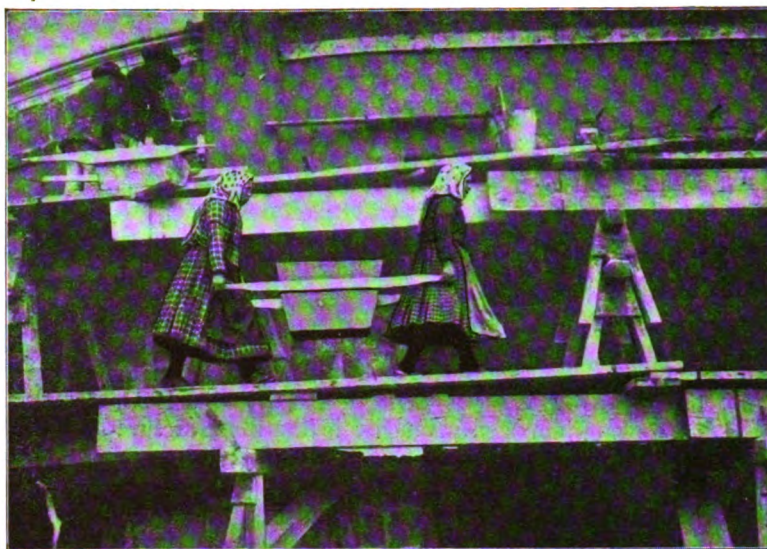
A description of the twenty-eighth annual meeting and exhibition of the American Foundrymen's Association at Milwaukee and also a review of new machine tools.

Pig iron output in September totalled 2,053,617 tons, an annual rate of 24,250,000 tons. The September production was 12.7 per cent over that of August and there was a gain of 24 active furnaces in the month.

More than 200 chemists, metallurgists, manufacturers and foundrymen met at Detroit for the forty-sixth meeting of the American Electrochemical Society, October 2, 3 and 4.

The thirteenth annual Safety Congress of the National Safety Council was attended by 3,500 persons at Louisville. Carl B. Auel, Westinghouse Electric & Manufacturing Company, was elected president of the council.

Steel ingot production in September showed a gain of 10.7 per cent over August. The average daily production was above 100,000 tons for the first time in five months and was at the annual rate of 33,670,000 tons, compared with an annual rate of 30,400,000 tons in August. Pig iron specifications are of larger volume, although new buying is quiet.



This is what American labor must compete against.

More interest is noted in iron for the first half and some good bookings for that period are reported. Price weakness is apparent in the Pittsburgh District and in the East. Manufacturers of sheets in the Youngstown District are losing considerable business in the Chicago territory as a result of the abolition of the Pittsburgh plus system. Many complaints are being made against short haul steel rates and the Commerce Commission will be asked to take action.

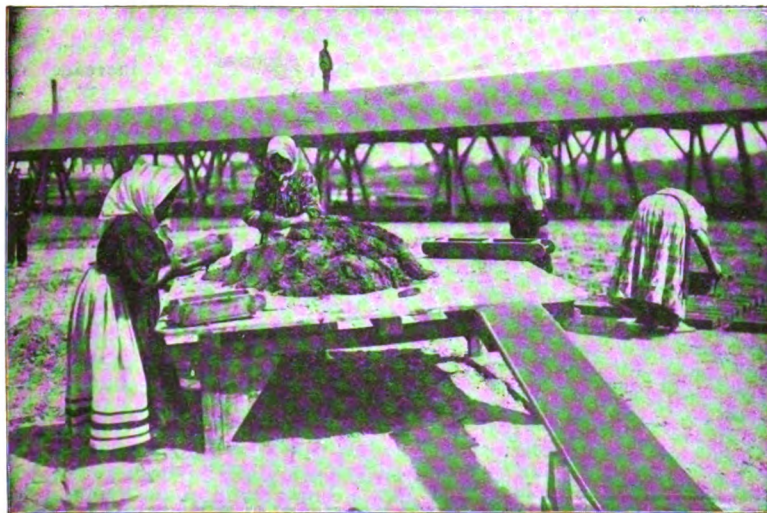
An article analyzing the position of the sheet makers in the Youngstown District with respect to new market conditions.—Iron Trade Review.

Can We Compete?

Ultimately the products of American manufacture must compete in the world markets. Just how difficult a problem this may become, when shattered Europe regains her balance and arrays her underpaid working forces against the present American standard of living wages, is graphically shown by the accompanying cuts.

"What fair or square American would ask American Brick Manufacturers to pay American union wages and compete with the 60 cent Holland labor here shown.

No real red blooded American, who has any spirit of fair play about him, would sanction or tolerate such unfair, unjust and ruinous conditions. Buyers of foreign made brick may think they are saving money but they are only buying a scourge of withering blight on the capital and labor employed in eastern brick plants."—American Clay Magazine.



A typical picture of Dutch brick making.

TECHNICAL ARTICLES

High Manganese Steel for Locomotives — Segment Patterns and Core Work Extensively Used by General Electric Company — Clipping and Machining Lessened by Reduction of Risers and Webs.

Studebaker Gray Iron Foundry Largest — Raw Material Storage Bay Entirely Covered and Inclosed — Special Sand Storage and Handling Features.

Heat Treatment of Gray Cast Iron.

Proportioning and Shaping of Sink Heads.

New Annealing Equipment for Strip Steel — Electric Mule on Rack for Charging — Ample Combustion Space in Furnaces — Arrangement for Cooling Boxes and Quick Charging of Furnaces.

Electric Furnaces for Heating and Melting — American Electrochemists Cover New Ground in Discussing Electric Industrial Heating and Corrosion — Session Electric Furnace Cast Iron.

Building Diesel Oil Engines for Ford — Crankshaft Bearings Planed Instead of Bored — Special Fixture Made for Jointing Bedplates — Crankshafts Turned Direct from Forged Block.

New Type of Mechanical Hot Bed—Elliptical Moving Members Insure Proper Advance of Rails, Billets, etc., with Less Direct Transfer of Heat—Special Cooling Apparatus.

Multiple System of Electric Melting—"Twin Furnace" Plan as applied to a Steel Foundry—Greater Speed in Melting and Less Equipment Claimed.

Metals Used In World Cruiser Airplanes.

Making Steam Turbine Diaphragm Blades—Novel Planer Fixture Permits Planing at Several Angles—Centrifugal Babbiting of Large Bearings—Unusual Radius Tool.

Handling by Electric Truck.

—Iron Age during October.

Motor Vehicles

Washington, D. C., October 10, 1924. The Department of Commerce announces that, according to data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of motor vehicles in that year produced 3,472,420 gasoline or steam-driven passenger vehicles, including chassis, valued at \$2,277,800,046; 12,878 public conveyances, valued at \$24,667,251; 1,192 Government and municipal vehicles, valued at \$10,051,776; 402,408 business vehicles, including chassis, valued at \$295,868,451; 1,236 electric vehicles, including chassis, valued at \$3,059,906; and 11,191 trailers, valued at \$4,233,069; together with other products valued at \$547,647,375, making a total of \$3,163,327,874. This total represents an increase of 89.3 per cent as compared with 1921, the last preceding census year. The output of motor vehicles of all classes, including chassis, totaled 3,890,134 in number and \$2,611,447,430 in value. (The values here given are f.o.b. factory.)

The foregoing figures and the other statistics here-with relate to manufacturers whose principal products

were assembled motor vehicles, and do not include data for the production of establishments engaged primarily in the manufacture of bodies, parts, and accessories for motor vehicles.

The proportion of closed passenger cars has increased from 10 per cent in 1919 to 21.6 per cent in 1921 and 35.1 per cent in 1923. The number of this class of motor vehicles (not including electric cars) manufactured in 1923 reached a total of 1,201,316, compared with 303,687 in 1921 and approximately 156,000 in 1919.

Of the 351 establishments reporting, 54 were located in Michigan, 46 in Ohio, 32 in Illinois, 30 each in Indiana and New York, 28 in California, 26 in Pennsylvania, 20 in Wisconsin, 14 in Massachusetts, 11 in Missouri, 9 in New Jersey, 6 each in Minnesota and Iowa, 5 each in Connecticut, Texas, and Washington, and the remaining 24 in Colorado, District of Columbia, Georgia, Kansas, Kentucky, Louisiana, Maryland, Nebraska, New Hampshire, North Carolina, Oklahoma, Oregon, South Carolina, and Tennessee. In 1921 the industry was represented by 385 establishments, the decrease to 351 in 1923 being due to the omission of 97 establishments which had been included for 1921 and the inclusion of 63 which had not been classified in this industry for that year. Of the 97 establishments omitted, 48 had gone out of business, 28 were idle throughout the year 1923, 14 had been engaged primarily in the manufacture of motor vehicles in 1921 but reported other commodities — motor vehicle bodies and parts, machine shop products, and carriages and wagons—as their principal products for 1923 and were therefore classified in the appropriate industries, 5 were not engaged in manufacturing during any part of the

THE MOTOR VEHICLE INDUSTRY

General Statistics

	1923	1921	Per cent of increase*
Number of establishments.....	351	385	-8.8
Wage earners (average number)†.....	241,356	143,658	68.0
Maximum month.....	May 258,111	May 165,636	...
Minimum month.....	Jan. 216,383	Jan. 81,125	...
Per cent of maximum.....	83.8	49.0	...
Wages	\$406,730,278	\$221,973,586	83.2
Paid for contract work.....	\$1,961,141	\$982,593	99.6
Cost of materials (including fuel).....	\$2,147,463,352	\$1,107,062,085	94.0
Products, total value.....	\$3,163,327,874	\$1,671,386,976	89.3
Value added by manufacture‡.....	\$1,015,864,522	\$564,324,891	80.0
Horsepower	441,945	(d)	...
Coal consumed (tons of 2,000 lbs.).....	1,797,920	(d)	...

PRODUCTS—NUMBER, BY CLASS

	1923	1921	Per cent of increase*
Passenger vehicles, number.....	3,419,425	1,442,289	137.1
Value up to \$500.00.....	1,727,958	999,356	154.4
501.00 to \$800.00.....	814,090	278,278	138.7
\$801.00 to \$1,500.00.....	664,189	123,236	38.7
\$1,501.00 to \$2,500.00.....	170,948	33,421	-7.5
\$2,501.00 to \$3,500.00.....	30,903	7,998	41.7
\$3,501.00 and up.....	11,337		
Motor trucks, delivery wagons, busses, sight-seeing wagons, and chassis, number.....	403,910§	144,821	178.9
Up to ¾ of ton.....	75,173	27,002	178.4
From 1 to 1½ tons.....	282,386	93,853	200.9
From 2 to 3 tons.....	30,701	16,463	86.5
From 3½ to 5 tons.....	13,231	6,433	105.7
From 5½ tons up.....	2,419	1,070	126.1

* A minus sign (-) denotes decrease.

† Not including salaried employees and proprietors and firm members. Statistics for these classes will be given in final report.

‡ Value of product less cost of materials.

§ Includes 1,399 motor busses and sight-seeing wagons and 975 electric delivery wagons, trucks, and chassis, but does not include 872 hearses and undertakers' wagons.

year, and 2 reported products valued at less than \$5,000. (No data are tabulated at the biennial censuses for establishments with products under \$5,000 in value.)

The statistics for 1923 and 1921 are summarized in the following statement. The figures for 1923 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

The total production of motor vehicles as reported at the 1923 biennial census of manufactures differs from the aggregate number as reported in the monthly commercial reports, namely, 3,637,216 passenger cars and 376,293 trucks, by reason of the facts that—(1) The figures in the case of the biennial census relate to production, whereas the monthly figures as published in the monthly commercial reports, relate in many cases to factory sales rather than to production. (2) While the biennial statistics pertain as nearly as possible to the calendar year ended December 31, 1923, a few manufacturers reported for their business years most nearly conforming to the calendar year.

X-Ray Diffraction

Cornell University and the University of Michigan have ordered X-ray diffraction equipments for use in their physics laboratories. The metallurgical, geological and other departments will also use the outfit.

The equipment will be furnished by the General Electric Company, in whose research laboratory this X-ray method of studying crystal structure was developed.

Six similar outfits are already in use in college research laboratories, including Massachusetts Institute of Technology, Rensselaer Polytechnic Institute, McGill University, Pennsylvania State College, University of Wisconsin, and California Institute of Technology. Two industrial research laboratories and two government laboratories are also equipped with this type of apparatus. The General Electric Company itself is constantly using two sets.

By means of the apparatus, characteristic X-ray diffraction patterns of fifteen powdered crystals can be recorded photographically at once. The results obtained have an immediate field of usefulness in the theory of metallurgy and in certain branches of physical chemistry, as well as in chemistry and geology. The apparatus is suited not only to general crystal research, but to most forms of routine commercial laboratory work.

—General Electric Bulletin.

The tests reported in Bulletin No. 143 of the Engineering Experiment Station of the University of Illinois were undertaken with a view of obtaining definite information concerning the positive and negative pressures found in soil-stacks, waste pipes, traps, and vent pipes, and also concerning the limitations of rates of discharge and the capacities of waste pipes and soil-stacks. It is believed that the results obtained from these tests and the principles established will be helpful when making designs of plumbing installations, and in reducing the complication and cost of plumbing work.

The principal problems discussed in the bulletin are the proper type and capacity of vents for various conditions, the causes and methods of preventing self-siphonage of traps, the capacity of coil-stacks, and the effect on the pressures in a plumbing system resulting from (a) clos-

ing the top of the soil-stack, (b) mixing solid matter with the discharge from water-closets, (c) changing the length of the horizontal pipe in the basement to which the soil-stack is connected, (d) changing the height of fall in the soil-stack, (e) changing the rate of discharge, (f) the use of a house trap, and (g) submerging the outlet from the plumbing system, as may happen when the water in the street sewer rises above the outlet of the house sewer or when roof water, discharging into the house drain, overcharges it.

Copies of Bulletin No. 143 may be obtained without charge by addressing the Engineering Experiment Station, Urbana, Illinois.

Analyzing Unemployment

Averaging good and bad years, 10 to 12 per cent of all the workers in the United States (several millions of men and women) are out of work all the time. Widespread unemployment is now a constant phenomenon with far-reaching economic, social, psychological and moral bearings. In seeking work through certain types of commercial or fee-charging employment bureaus, particularly those dealing with unskilled and casual labor, thousands of men and women are being exploited. Public employment bureaus or exchanges can make a material contribution toward the solution of this and other phases of the ever-recurring problem of unemployment.

These are some of the facts brought out in the introduction to the report of a five-year study of employment methods, needs and agencies, which has just been made public by the Russell Sage Foundation. It is made clear in the report that the figures on unemployment, while representing the average of the country's experience during the last two decades, are not necessarily indicative of present conditions or of the last year.

The investigation, which extended into more than 70 cities in 31 states and Canada, has just been completed. The full report, covering more than 600 printed pages, will be issued shortly. The survey was conducted by a staff of trained field investigators, all of whom had previously been engaged in employment work, under the direction of Shelby M. Harrison, director of the Foundation's Department of Surveys and Exhibits.

Practically every known means for bringing work and the worker together was studied. The "want ad" pages of newspapers, the fee-charging labor agencies, the free public employment office, the labor union's method of securing work for its members, the fraternal order's activities in this field, the practice of applying for work at the factory gate or the office door, all were investigated. The report will point out the advantages and disadvantages to employer and employee in each of these means and its effect on the general employment situation.

A special study was made of the situation in Ohio, Wisconsin, Massachusetts and New York, where there has been the greatest development of organized public employment work. Separate studies were made also of the special problems of farm labor, migratory and casual workers, junior workers, handicapped workers, immigrants, Negro workers, and professional workers.

After citing the fact that each year from 1,000,000 to 6,000,000 persons are out of work for weeks and sometimes for months at a time, the introduction to the Foundation's forthcoming report says:

"There is something which we are just beginning to recognize—a resentment on the part of the workers against an industrial situation in which such insecurity and uncertainty of employment are possible. It is not only unemployment, but the fear of unemployment—the knowledge that any job is uncertain and insecure, subject to the fluctuations of economic change—which is responsible for much of our present industrial unrest."

This situation, the report will show, has been aggravated by the fact that the unskilled worker who has sought employment through certain types of labor agencies in many cases has been subjected to such abuses as paying a fee and then failing to get a job; being sent to distant points where no work or where unsatisfactory work exists, but whence he could not return because of the expense involved; being employed through collusion between the agent and employer and after a few days' work being discharged to make way for a new workman while the agent and employer divided the fee.

The report of the Russell Sage Foundation says:

"One conclusion drawn from such findings has been that we must have public bureaus to take the place of the private fee-charging agencies. That is, in so far as people are informed on the question and have expressed their sentiments, most of them appeared convinced that we should have public employment bureaus because of the abuses of some fee-charging agencies quite regardless of other considerations. In addition, however, the feeling has been growing that this service in the nature of the case should be free, and that the very fact of fee-charging carries with it a dangerous temptation to abuse and fraud.

"It is obvious, of course, that if the public exchanges could by legislation or court action secure exclusive sway in the whole field, the fee-charging agencies with the abuses attributed to them would be bound to disappear. And such a plan, aimed to abolish these agencies, particularly those dealing with unskilled, semi-skilled, casual, and other non-professional workers, is what some advocates of the public exchanges would adopt. There is, however, serious question whether action of that kind, if it were possible, would be wise. The mere abolition of a thing does not always help the situation. That is only negative. It is more important to build up a good constructive competing organization. The abolition alone of the private fee-charging agencies would not necessarily bring about a system of public employment bureaus nor an efficient system. With all their abuses the private agencies are performing a function needed in the absence of an adequate public system; they should not be abolished until something is provided to take their place.

"It would seem far more practical to set to work on a positive program of improving the public bureaus, for if we get a good public service, the fee-charging agencies and their abuses will then become a minor question. The private agency will be eliminated because it will be useless; or we shall learn how to improve it through experience gained in the public bureaus."—Russell Sage Foundation.

Hubbard Company Adopts Group Insurance

A \$1,000,000 group insurance program to cover 800 employes has been put into effect at the three Pittsburgh plants of Hubbard & Company, manufacturers of shovels, spades, spikes, picks, etc.

The bulk of the insurance, which was written by the Metropolitan Life Insurance Company, was issued on the contributory plan, whereby the Hubbard Company and the workers jointly pay the premiums. However, \$180,000 of the total amount was issued free of cost to 90 employes, who have been in the service of the company for 15 years or more.

Under the terms of the insurance contract, the coverage of individuals ranges from \$1,000 life, death and dismemberment insurance to \$3,000, the amounts being governed by occupation and length of service.

Certain classes of workers are also entitled to accident and health insurance carrying weekly benefits of from \$10 to \$15.

A special offer is made by the Hubbard Company to employes who have served 15 years or more. In such cases the company will pay full premiums for \$2,000 life, death and dismemberment insurance, and on accident and health insurance carrying a weekly benefit of \$15 a week.

These workers, however, are entitled to an additional \$1,000 life insurance and \$1,000 death and dismemberment insurance, the premiums to be paid jointly by company and employee.

Besides the actual provisions of the insurance contract, certain service advantages are being offered by the Metropolitan. Among these are the distribution of instructive health pamphlets and a free visiting nurse service.—Metropolitan Bulletin.

Barrett Company Sues for Renewal of Tar Contract

An injunctive suit to prevent the Laclede Gas Light Company from breaking its contract to sell coal tar products to the Barrett Company, manufacturers of a paving composition, was filed in Federal Court recently.

After filing of the bill of complaint, which alleged that unless relief was given, the Barrett Company would suffer irreparable loss to its business, Federal Judge Davis issued an order against officials of the Laclede Company directing them to show cause why an injunction should not be issued.

The plaintiff company, which is incorporated under the laws of New Jersey, and has factories throughout the United States, including one at St. Louis, alleges that the Laclede Company, from which it has purchased by-products under contract for 25 years, has refused to renew the contract, although a five-year contract, which has until the end of 1924 to run, gave the Barrett Company an option on another five-year contract.

Officers of the Laclede Company also were restrained in Judge Davis' order in disposing of any coal-tar products to companies competing.

In its bill of complaint, the Barrett Company declared that if its supply of coal-tar products was cut off by the Laclede Company, it would be unable to obtain these supplies at reasonable prices elsewhere, and thus its business would suffer damage.

The Barrett Company distills the coal-tar products into a patented composition for paving purposes.

Examination of Steel by X-Ray

Report on Spectrometer Equipment at the Government Arsenal, Watertown, Mass.

By L. C. BREED*

The present equipment has a nominal capacity of 300,000 volts, but the maker will not guarantee any life of a potential higher than 200,000 volts. It is expected to raise the limits ultimately to even 500,000 volts so that it will be possible to examine steel five or six inches in thickness.

For the protection of those using the apparatus it is installed in a room lined with steel one quarter of an inch thick. Every joint and securing screw was similarly covered. A lead-lined periscope containing two mirrors enable the operator to view with safety the Coolidge tube while making an exposure. In the examination of steel three inches in thickness, the time exposure was about 30 minutes. The cost of such an installation of equipment may be upwards of \$10,000.

The study of these films has resulted sometimes in changing from a casting to a forging; several of them have resulted in changing the method of molding or of pouring, with the result of obtaining entirely satisfactory castings. Some films have shown that the designer has called upon the foundry to produce what was not producible.

Besides revealing cavities and the presence of sand, the apparatus will reveal metal that has been burned and also the presence of very fine shrinkage cracks; in one case a fine crack in a forging caused by working at too low a temperature.

Another useful field is that of enabling the designer to know the location, volume or quantity and the character of defects in castings, and consequently he has been able in several instances by chills, etc., to locate the shrinkage cavities where they do no harm.

A comparatively small shrinkage cavity which exists because of the separation of the metal after it has solidified can be recognized. The surfaces are fracture surfaces and cannot be distinguished from the rest of the broken face by their appearance. Unless a point contour diagram over a square millimeter of both faces is made the existence of the shrinking cavity will not be recognized. Yet it may have been the cause of fracture taking place at that particular point. But take a picture of the piece with X-rays and the shrinkage cavities are recognized at once by their characteristic outline. At the same time blowholes would be identified by their smooth boundaries and slag inclusion by a patchy appearance.

This non-destructive testing equipment has found a secure, if, as yet, somewhat limited place. Roughly, this means that with this apparatus, it is possible to get even in a ten-minute exposure, what under previous conditions would have required several thousand hours. Aside from the higher voltage of the tube, some of this reduction in time is attributable to the higher efficiency of the screen and the greater sensitivity of the film now available. In these tests Eastman supersensitive film (duplitzed) and a Patterson double intensifying screen were used.

*Boston, Mass.

Summary of results in taking X-ray diffraction patterns.

The following specimens were examined: Electrolytic iron, not annealed; carbon steel, martensitic with trace of austenitic; carbon steel, martensitic with trace of troostitic; carbon steel, troostitic with trace of martensitic; carbon steel, troostitic with trace of sorbitic; carbon steel, sorbitic; carbon steel, sorbitic; carbon steel, sorbitic, showing beginning of spheroidizing of cementitic.

"It was found that, for ordinary temperatures, in plain carbon steels of hyper-eutectoid composition, the crystal structure, as shown by the X-ray spectrometer, varies through a continuous series from that existing when the metal has been very rapidly cooled from a temperature in or above the critical range to that existing when the cooling has been very slow from a temperature above the critical range.

Typical micro-structures are developed in such steels depending upon the portion of this series to which the crystal structure existing in them belongs. These typical micro-structures have long been recognized and the range of the crystal structures which each indicates has been shown to be as follows:

1. The martensitic micro-structure indicates the existence of (a) and (y) iron crystals, the proportion of (a) iron crystals decreasing and the proportion as the structure approaches the troostitic. The space lattices of the (y) iron crystals apparently do not suffer much, if any, distortion as long as any of these crystals exist. The space lattices of the (a) iron crystals, however, are probably somewhat distorted, the distortion decreasing as the troostitic structure is approached.

2. The troostitic structure represents a condition in which iron crystals are present only in the (a) form. The space lattices of these crystals are also probably somewhat distorted, but to a lesser extent than in the martensitic structures. As structure approaches the sorbitic this distortion of the space lattices decreases.

3. In the condition denoted by the sorbitic structures, there exists a mixture of (a) iron and very minute iron-carbide crystals. The probable distortion of the space lattices of the (a) iron crystals disappearing and the size of the iron carbide crystals growing as the micro-structure approaches the pearlitic.

4. In the alloys having the pearlitic and cementite structures there is a mixture of perfectly formed (a) iron and iron carbide crystals.

The X-ray diffraction patterns of this series do not definitely indicate the disposition of the carbon atoms in the martensitic and troostitic micro-structures. They do not positively show the presence of iron carbide crystals nor do they produce evidence that very minute crystals of the compound do not exist."

Hermann H. Zornig, in "Army Ordinance", thus gives an account of his attempt through working in the laboratories in the U. S. Watertown Arsenal, to

produce one series of X-ray diffraction patterns. The X-ray spectrometer used in these experiments was the standard X-ray diffraction apparatus, manufactured by the General Electric Company. In order to adapt this apparatus to take specimens of the shape found to be best suited to this work, one of the cassettes was slightly modified. This consisted only of the addition of a special specimen holder.

Three general forms of specimens were chosen, namely, the powdered material contained in tubes or in films of amorphous materials, the material drawn or otherwise formed into fine wire or narrow flat surfaces of the material such as the edges of ribbons. Of these, the form was chosen because it permitted the use of specimens which could be easily heat treated and in which the surface layer of the diffracting crystals could readily be examined microscopically. The specimens were prepared from a piece of 1.50 inch (3.805 em.) diameter, round, hot rolled bar stock. This was carefully forged down into several strips about 0.187 inch (0.475 em.) by 0.085 inch (2.22 em.) by 14 inches (35.5 em.) in size. These strips were reduced by grinding to a section of 0.085 inch (0.215 em.) by 0.75 inch (1.9 em.) care being taken to remove about the same amount of material from opposite sides. They were then cut into lengths of about 1.25 inch (3.17 em.).

Drillings, taken from the tonghold (about 1 inch [2.54 em.] square section) which had been left on one of the forged strips, were analyzed to obtain the chemical composition of the specimens.

The specimens were next heat treated. After heat treatment, the diffracting surface of each specimen was polished, etched, and examined microscopically. In every case a slight amount of surface decarburization was found. The decarburized surface layer was carefully removed from the top and sides of the specimen by hand, using a fine file, or where the specimens were very hard, by a slow-moving grindstone well covered with water. The removal of surface metal was in each case continued until the whole of the surface showed, after polishing and etching a uniform surface upon microscopic examination. The width of the diffracting surfaces was at this time brought to 0.7 m/m 0.05 m/m.

Photo-micrographs were made of the prepared surfaces at magnifications of 100 and 2,000 diameters. The etching re-agent used in all cases was a 2 per cent solution of nitric acid in alcohol. The photo-micrographs, which were taken at a magnification of 2,000 diameters, show the details of the structure existing in each specimen.

Apprentices Attend Carnegie Tech

(Continued from page 507)

apprentice training plans, labor union organizations and employers associations have already joined hands in several cities in order to make agreements similar to those now in operation at the local institution. Both Dr. Connelley, and President Thomas S. Baker, who has taken an active interest in the apprentice training movements, predict that the current year will see many such plans effected throughout the country.

Among the novel and somewhat radical terms of the agreement in the contract this year between the

local sheet metal workers union and the Pittsburgh sheet metal contractors association for the training of apprentices is the stipulation that every apprentice attached to the union "must and shall attend Sheet Metal Classes at Carnegie Institute of Technology the last four years of his apprenticeship, or until he has finished the course for Sheet Metal Apprentices. The extent of co-operation to which the employers have committed themselves to assist in the training is recorded in the section of the agreement which says: "The employer shall send the apprentices to the Carnegie Institute of Technology for trade instruction one day each week from October 1 to May 1 during the last four years of his apprenticeship. The apprentice shall be allowed his regular wage for days while attending school."

The course of instruction includes geometrical drawing, mathematics, pattern drafting, and ship practice. Each apprentice pays his own tuition fee, which is rated according to the fees charged for the night courses of similar scope.

The plan for the training of the 15 apprentices of the local metal lathers union, which was made with Carnegie Tech upon the request of the union, has already received the endorsement of the international officials of the International Wood, Wire and Sheet Metal Lathers Union. Beginning during the week of October 6, evening classes for this group of apprentices was resumed in mathematics, mechanical drawing, and shop work. In both cases, the instrumental work will be in charge of the Department of Building Construction of the College of Industries.

—Carnegie Inst. of Tech. Bulletin.

German vs. American Automobile Industry

An interesting analysis of the American and German automobile industries has been contributed by Dr. F. E. Junge, Consulting Engineer, New York, to "Transatlantic Trade," issue of July, 1924, the illustrated journal of the American Chamber of Commerce in Berlin. This report is as follows:

According to the U. S. Census Report of 1923, the wage level of American labor—taking the average of all trades—ranges from \$5 to \$12 a day, the lowest paid worker being the shoemaker and the highest the bricklayer and plasterer. This leaves out of consideration agricultural and domestic wages, with which the comparison in this essay is not concerned.

Taking particularly the automobile industry of America, we have the unique situation that its standards of production and therefore also its prices and wages are largely dominated by one man, Henry Ford, who alone produces about 96 per cent of the low-priced cars of the country and pays a minimum wage of \$6, or 25 gold marks, for an 8-hour day.

To ascertain the corresponding wage level in Germany is no easy task, owing to the fluctuations of currency which have occurred and to the changes of purchasing power of the money which are still occurring; and we must remember that it is not the amount but the margin men have between their income and the minimum necessary to support their families which is the real measure of the daily wage.

Another complication which impairs the correctness of an investigation of German wages is the dif-

(Continued on page 523)

The Birmingham Meeting

American Institute of Mining and Metallurgical Engineers Hold
Their 130th Session—Sir William Ellis Fails to Arrive

WITH characteristic efficiency the 130th session of the American Institute of Mining and Metallurgical Engineers got under way. The technical sessions included the opening of the institute when George G. Crawford, president of the T. C. I. Company, welcomed the engineers. His remarks were brief but none the less cordial and emphatic in the assurances that not only were the associated engineers of the district honored by the gathering coming to Birmingham, but the citizens of the district as well.

William Kelly, president, responded for the Association. He said that marvelous and interesting work had been done in the Birmingham district and the Association felt a measure of pride in what had been done on account of the fact that some of its members had participated in the work that had brought fame to the district.

"Coal Washing Practice in Alabama."

Mr. H. S. Geismer read excerpts from his paper on coal washing practice in Alabama, and pointed out many interesting local conditions. Mr. Geismer said the large percentage of Alabama coal was washed and one of the troubles encountered was the effect of released sludge on vegetation and plant life along the streams of the state. The visitors were told of the many damage suits which developed and the discussion brought out that considerable progress had been made in eliminating that situation.

"Production of Ferrophosphorus in the Electric Furnace," by Theodore Swann, Birmingham.

Frank H. Crockard, president of the Woodward Iron Company, presided at the afternoon session. He carried the program with the same efficiency that characterized the efforts of his former chief when Mr. Crockard was associated with Mr. Crawford. The discussion of the paper by Theodore Swann on the operations of his electric furnaces at Anniston carried perhaps more sparks than the other. Mr. Swann, who is one of the youngest industrialists of the district, read a paper entitled, "Production of Ferro Phosphorus in the Electric Furnace," and was the mostly highly technical of all read.

"Blast Furnace Practice in Alabama," by H. E. Mussey, Woodward Iron Company, Woodward, Ala.

His paper was discussed by some of the leaders, and was designated by many visitors as very timely. Howard Mussey of the Woodward Company offered a paper on blast furnace operations. He has a wide experience in that work, having been at the Ensley plant for some time. His paper described innovations at Woodward which are not only new to the district but to furnace operations elsewhere.

"By-Product Coking."

By Frank W. Miller, superintendent by-product plant, Sloss-Sheffield Steel & Iron Company. This paper by a former Semet-Solvay expert brought forth much interesting discussion.

"Alabama Steel Industry."

By Col. James Bowron, chairman, Gulf States Steel Company. This was one of the feature speeches of the meeting. Col. Bowron reviewed the inception and tremendous growth of the southern iron and steel industry, and discussed informally its various phases, difficulties and possibilities.

At the conclusion of the day technical sessions, announcement was made of the inspection trips which had been arranged for all visitors. Several choices were offered. A visit to the Employees' Hospital of the Tennessee Coal, Iron & Railroad Company at Fairfield; the Shannon ore mines of the Gulf States Steel Company, being the leading choices. Both points of interest were heavily attended.

At the night session technical discussions included:

"Geology of the Birmingham Iron Ores."

By Dr. E. F. Burchard, United States Geological Survey.

"Iron Ore Mining Practice in Alabama."

By W. R. Crane, superintendent, Southern Experiment Station of the Bureau of Mines.

"Geology and Utilization of Tennessee Phosphate Rock."

By W. R. Smith, Assistant State Geologist of Tennessee.

"Manufacture of Ferrophosphorus at Rockdate, Tenn."

by James A. Barr, Mt. Pleasant, Tenn.

Expansion Program Under Way

The Carnegie Steel Company, Pittsburgh, Pa., is proceeding with the improvement program at its Homestead, Pa., plant arranged earlier in the year, and will expend a gross of close to \$25,000,000 over a 48 months' period at this works. Immediate work will include a 44-in. and 36-in. blooming mill, respectively, with complete equipment for electric drive. A new 28-32-in. structural mill will also be erected at

an early date, with other structural mills to be built later, to replace older units at the plant. Work is also under way on expansion and improvements at the Duquesne plant, to include the remodeling of the present 38-in. blooming mill and the installation of considerable additional equipment. Electric power equipment will be installed to replace the present steam-drive. A large fund has also been arranged for this expansion.

The POWER PLANT

Reconstructing Boiler Furnace Walls

An Effective Method of Waste Recovery

COMPLETE side wall and front wall patches using crushed old furnace linings as a refractory base, are being successfully used on oil burning boiler furnaces at the Glenwood, N. Y., Power Station of the New York Central Railroad Company.

This method of construction was tried out by the plant superintendent and a recent inspection of one of the walls so repaired shows it to be in excellent condition after eight months' service.

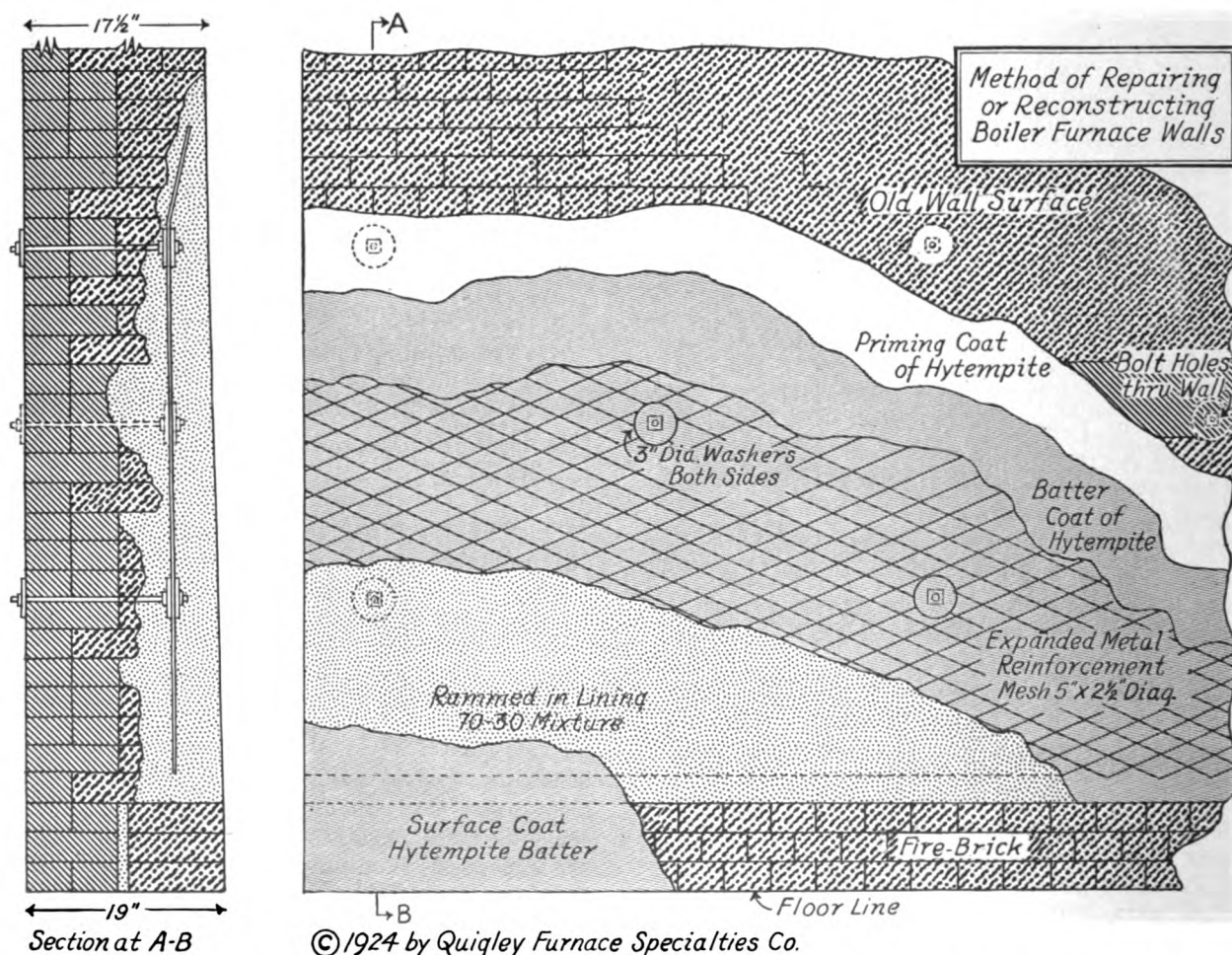
For the side wall patches, expanded metal reinforcement is embedded in the patch and anchored through the wall, using $\frac{5}{8}$ -in. bolts placed at suitable intervals.

The service required is unusually severe, not only on account of the use of oil fuel, but for the fact that

this station is used to carry peak loads morning and afternoon, with a consequent cooling and heating of furnace walls twice in each 24 hours.

The work done illustrates admirably how much old material can be picked up around the plant and put in service.

The expanded metal used happened to be some left over material such as is used for reinforcing concrete floors and roads. All of the materials for patching work of this sort, are, as a rule, available around any boiler plant, with the possible exception of the expanded metal. The metal used for this work is soft open hearth steel, which can be secured in standard sizes measuring 5 ft. 3 in. wide in 8 or 10 foot lengths, at a cost of approximately \$6.50 per hundred sq. ft.



Sectional view of reconstructed boiler furnace wall and side view showing the successive steps in the application of the repair, beginning with the priming coat and finishing with a surface coat over the rammed-in lining.

Bolts and washers of suitable size were found around the plant and the refractory material used was crushed old fire brick which had already seen service at high temperature in the same furnaces. This was crushed to $\frac{1}{4}$ -in. mesh, using the fines, and mixed with high-temperature cement in proportion of 70 lbs. of crushed brick to 30 lbs. of the cement. In making the mixture, the cement was first diluted to a heavy pancake batter, and the crushed material gradually added and thoroughly mixed.

One of the walls repaired, as shown in the accompanying diagram, was eaten away to the full depth of the first brick lining, so that the red brick was exposed.

In preparing the wall, all loose material was removed, leaving as far as possible, the fire brick headers projecting into the space to be patched. The metal reinforcement was then placed and bolts attached, holes through the wall being easily made with an air hammer. Three courses of fire brick were laid at the floor line, giving the wall a thickness of 19 in. at that point, so as to permit the patch to slope back slightly—about $\frac{1}{4}$ in. to each foot in height. This was done to prevent bulging of the wall.

A wood form was then erected in sections and the crushed old fire brick mixture rammed in behind the form after the old wall surface had been prepared with a priming coat of thinned high temperature cement followed by a coat of batter made from the same cement. This batter coat was applied sectionally as the ramming-in progressed, so as to insure a moist surface that would bond the crushed fire brick mixture to the old wall.

The whole job, including a surface wash of thinned Hytempite batter over the reconstructed wall, was completed within two days.

This method of reconstruction prevented the tearing out of entire side walls and continues to give excellent results in service.

Power Show to Feature Lectures

The Third National Exposition of Power and Mechanical Engineering will feature a series of lectures on recent developments in important phases of power plant and mechanical engineering practice. The exposition will be held in the Grand Central Palace, New York, from December 1 through 6, 1924, and the lectures will be held in the assembly hall at times that will not conflict with the more formal papers presented at the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers which parallel the first four days of the exposition.

A large number of schools of mechanical engineering will send delegations of students and instructors to the exhibition and a series of lectures is planned to give the students, and any others who may be interested, a complete picture of recent developments of power plant and mechanical engineering practice with the exposition as a background. The lectures will be supplemented with visits to the various exhibits. The topics selected are: The Boiler Room, Steam Prime Movers, Oil and Gas Engines, Hydro-electric Power Plant Equipment, Materials Handling, Modern Machine Tool Developments, Mechanical Power Transmission, Mechanical Refrigeration, Heating and Ventilating.

The selection of speakers has not been completed, but leaders in the respective fields will be chosen.

The selected list of technical moving pictures which was shown last year attracted large crowds at the several showings. At the coming event the picture program will be elaborated by recent releases which will add greatly to the novelty and interest of the show.

The exhibits, which will occupy 150,000 square feet on three floors of the Palace, will include a complete showing of all lines of power plant apparatus and accessories, materials handling equipment, and many showings of heating and ventilating apparatus, refrigerating machinery, machine tools, and machine shop equipment. As the exposition attracted all types of mechanical engineers and industrial executives and operating men, the manufacturers of machine tools and shop equipment have come to realize the opportunity they have to display their products before an excellent audience and many of them have purchased space at the coming show.

In the same way, the addition of heating and ventilating equipment and refrigerating machinery adds greatly to the diversity and interest of the show and the final result is an exhibition in which every mechanical engineer and industrialist will find much of novelty and value.

The exposition is now attaining the ideals of its advisory committee and founders in that it is becoming a national clearing house for new developments and new ideas in the field of power generation and utilization.

Smoke Nuisance May Be Eliminated

That the smoke nuisance in cities such as Pittsburgh, Pa., Salt Lake City, Utah, and Ogden, Utah, may be eliminated is a possibility of the near future if experiments to be conducted this year at Carnegie Institute of Technology in Pittsburgh are successful. According to an announcement, steps have already been taken by the Department of Metallurgical and Mining Engineering and the U. S. Bureau of Mines to study the "utilization of the products of low temperature carbonization of coal with particular reference to the economic production of smokeless fuel."

The purpose of the study, which will be made by J. D. Davis, acting supervising chemist at the U. S. Bureau of Mines, and L. C. Karrick, a Carnegie Tech Research Fellow, is to devise means economically feasible for abatement of the smoke nuisance in cities such as Pittsburgh, Salt Lake City, and Ogden.

The growing urgent demand for some practical means of combating the smoke nuisance in such cities is given as the reason for the intended study by the Carnegie Tech authorities. Furthermore, according to the announcement, it has long been thought that a smokeless fuel might be prepared by low temperature carbonization of coal which would solve the problem.

That householders rather than industrial plants in such cities are "responsible" for the smoke nuisance, is an interesting statement in connection with the proposed study. "It is pretty generally recognized," says the announcement, "that the smoke condition of our cities is largely due to the domestic consumption of soft coal. This is due to the fact that soft coal is burned in domestic heating appliances with low efficiency, it being impossible to formulate rules for

combustion that will be generally observed by householders. The present research will have for its object primarily the investigation of the economic feasibility of applying low temperature carbonization in the cities mentioned."

In attacking the problem, authorities at the Institute and the Bureau of Mines intend to study the yields and qualities of the distillation products of a few typical coals in the laboratories of the Bureau of Mines at Pittsburgh, and to investigate the cost of plant, fabrication and revenue to be derived by sale of products in the vicinity of Pittsburgh, Salt Lake City and Ogden. The distillation method to be used has already been worked out on a laboratory scale and for the present investigation will be applied on a scale large enough to yield the data required.

Another investigation that may result, indirectly at least, in the saving of thousands of lives of coal miners from explosion disasters will also be made this year at Carnegie Institute of Technology in co-operation with the U. S. Bureau of Mines and an advisory board of coal mine operators and engineers. This problem is announced as a study of methods and costs of rock dusting in coal mines, rock dusting having become recognized in this country as being the most practical preventative of coal mine explosions ever devised.

"Investigations of the Bureau of Mines and the British Department of Mines," according to the announcement, "have proved that coal dust explosions can be prevented by spraying rock dust on the ribs and roof of a mine. Rock dusting is required by law in England and will no doubt be legally necessary in the United States within the next few years. Coal operators are asking the Bureau for information as to methods and costs of the process, and a complete study is desirable." This study will be made by C. W. Owings, assistant coal mining engineer, U. S. Bureau of Mines, and Charles E. Dodge, Research Fellow, Carnegie Institute of Technology.

Other problems announced for investigation this year by Carnegie Tech in co-operation with the Bureau of Mines and the Board of Coal Mine Operators and Engineers are:

The time-rate of combustion of coal dust particles of definite sizes; by C. M. Bouton, Associate Research Chemist, U. S. Bureau of Mines, and J. H. Hayner, Research Fellow, Carnegie Institute of Technology. This is a continuation of a 1923-1924 problem, which solved the preliminary step of sorting dust which would all pass through the finest commercial sieves into various finer sizes by means of air elutriation.

Underground coal loading machines; by F. E. Cash, mining engineer, U. S. Bureau of Mines, and Edwin H. Johnson, Research Fellow, Carnegie Institute of Technology.

(1) To develop simple methods of quantitative, microscopic, mineralogical analysis of clays and shales; and (2) to study by these methods the most available clays and shales associated with the coal measures of Pennsylvania to determine the suitability of rock dusting coal mines; by Alden H. Emery, Assistant Geologist, U. S. Bureau of Mines, and R. De Chicchic, Research Fellow, Carnegie Institute of Technology.

A comparative study of friction loss in mine cars with different types of bearings; by Mayo D. Hersey, U. S. Bureau of Mines, and Mark S. Downes and

Henry Shore, Research Fellows, Carnegie Institute of Technology.

A study of efficiency in blasting coal; by J. E. Tiffany, explosives testing engineer, U. S. Bureau of Mines, and B. L. Lubelsky, Research Fellow, Carnegie Institute of Technology.

Statistics on Mechanical Stokers

The Department of Commerce announces the following statistics on mechanical stokers according to reports received from 13 establishments. These data are shown by months for 1924 and 1923.

STOKERS SOLD, HORSEPOWER, AND KINDS OF INSTALLATION

Year and Month	Establishments reporting (number)	Stokers Sold		Installed under:			
		No.	H.P.	Fire-tube Boilers		Water-tube Boilers	
		No.	H.P.	No.	H.P.	No.	H.P.
1924							
Jan.	15	91	66,492	7	1,044	84	65,448
Feb.	15	110	62,113	11	1,525	99	60,588
March ..	15	89	34,597	12	1,625	77	32,972
April ...	15	89	47,939	15	1,970	74	45,969
May	15	64	34,447	3	550	61	33,897
June	15	102	35,549	19	2,724	83	32,825
July	15	115	37,759	14	1,660	101	36,099
August ..	13	94	41,931	17	2,486	77	39,445
Sept.	13	73	25,988	27	6,646	46	19,342
1923							
Jan.	15	145	83,270	29	3,400	116	79,870
Feb.	15	129	66,619	9	1,172	120	65,447
March ...	15	120	68,955	9	1,259	111	67,696
April	15	167	85,339	14	2,000	153	83,339
May	15	194	100,513	14	1,915	180	98,598
June	15	135	59,719	6	804	129	58,915
July	15	129	52,518	21	3,454	108	49,064
August ..	15	135	71,693	18	2,624	117	69,069
Sept. ...	15	99	60,486	16	2,754	83	57,732
Oct.	15	88	32,576	14	2,330	74	30,246
Nov.	15	50	16,241	10	1,300	40	14,941
Dec.	15	73	32,517	17	2,820	56	29,697
Total 1923	—	1,464	730,446	177	25,832	1,287	704,614

A. S. M. E. Annual Meeting, December 1-4

The forty-fifth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York City, December 1 through 4. For the third consecutive year the meeting will be held coincident with the Power Show.

High spots in the technical program include joint sessions of the Machine Shop Practice Division of the society with the special research committee on cutting and forming of metals, the special research committee on lubrication, and the management division respectively; a session on oil burning sponsored by the power and fuels divisions, and a session on the handling and storing of oil sponsored by the materials handling division.

A paper on the Zoelly Turbo-Locomotive, by Dr. Henry Zoelly of Switzerland, and a paper on The Petroleum Situation in the United States by Dr. Julian D. Sears, administrative geologist of the United States Geological Survey, will form other attractive features of the program.

New Officers of A. S. M. E. Elected.

The American Society of Mechanical Engineers announces the result of the election of officers for 1925 as follows:

President: Dr. William F. Durand, Stanford University, Calif.

Vice-Presidents: Prof. Robert Angus, Toronto, Canada; S. F. Jeter, Hartford, Conn.; Thomas L. Wilkinson, Davenport, Iowa.

Managers: John H. Lawrence, New York City; Edward A. Muller, Cincinnati, Ohio; Paul Wright, Birmingham, Ala.

Treasurer: William H. Wiley, New York City.

Delegates to American Engineering Council: Dr. William F. Durand, Stanford University, Calif.; Fred R. Low, New York City; Wilson P. Hunt, Moline, Ill.; I. E. Moulthrop, Boston, Mass.; E. N. Trump, Syracuse, N. Y.; William W. Varenny, Baltimore, Md.; Ira Dye, Seattle, Wash.; W. S. Finlay, Jr., New York City; Dean E. Foster, Tulsa, Okla.

New Haven Railroad Orders Freight and Switching Locomotives

The New York, New Haven & Hartford Railroad Company has ordered from the General Electric Company and the American Locomotive Company seven single-phase locomotives of a new type. Five of these units are for freight service and will be used on the main line between Oak Point and New Haven. The other two are switching locomotives and will be used in general yard service. Whenever double heading, these locomotives will function in multiple unit with the present single phase locomotives.

The design of this type of locomotive is somewhat unusual in that although it is actuated from a single phase trolley it does not have a.c. traction motors. Each locomotive, in fact, contains a traveling substation and will be equipped with a synchronous motor generator set for converting the 11,000-volt 25-cycle single phase supply to d.c., and with d.c. railway motors driving the axles.

Power is collected by the usual slider pantograph trolley and is delivered to a main transformer situated in the locomotive cab. This main transformer steps down the trolley potential to 2300 volts, which drives a single phase synchronous motor direct connected to the main generator. The main generator, which delivers current to the traction motors, is designed with a variable field and the speed of the locomotive is regulated by field control of this generator. The traction motors are of the standard series d.c. railway type, the performance of which is well known. They are geared to the axle through cushion type gears which allow a small movement of the gear ring about the gear hub or center, thus minimizing shocks and stresses in the gears and pinions.

Protective devices have been studied with great care. Between the pantograph trolley and the main transformer a time limit automatic oil circuit breaker is installed. Between the d.c. generator and the motors there are a high speed circuit breaker and line switches. The high speed circuit breaker will afford protection to both the motors and the generators and will ordinarily prevent the opening of the time limit switch or of the trolley or feeder sectionalizing switches and will thus prevent any interference with the continuous operation of the motor generator set.

The system of control, by varying the field strength of the generator used, in connection with the characteristics of the motor generator set, gives a

locomotive which is extremely flexible and adaptable to all operating conditions. It also has the very desirable characteristic of operating at a power factor of unity or better under all ranges of load. The set has been made of sufficient capacity to take care of the rated loads and will also furnish an appreciable amount of wattless current, especially at light loads for power factor correction. This tends to improve the trolley voltage for all load conditions and should be of material benefit in the operation of the entire system.

German vs. American Automobile Industry

(Continued from page 518)

ference which exists between the standards of living in the part of Germany rating far below the index or standards of the South and West. Even more pronounced is the difference of wage scales between town and country.

Now, keeping the above mentioned inequalities well in mind, it follows that between the minimum wages paid in German and American industries, namely, \$.50 and \$5.00, respectively, there is a ratio of 1/10. While between the maximum wages of \$2.00 and \$12.00, respectively, there is a ratio of 1/6. Hence if we make the latter ratio the basis of our comparison we are sure to understate rather than to overstate the facts of the situation.

After fixing the ratio of wages paid in the German and American automobile industries as 1/6, it remains to ascertain the corresponding ratio of prices paid for motor cars in the two countries. It is interesting to note in this connection that contrary to German practice there are in America practically no cycle cars or miniature automobiles in use, because even the low priced cars like the Ford, Overland, etc., have full size and standard equipment, the differences between the various makes concern only the power rating of the motors, the form of bodies and the quality of materials and accessories employed in the equipment. Hence the remarkably low price of automobiles in America is attained by mass production and efficient organization, not by a reduction of capacity, appearance or comfort of the cars.

With this fact in mind it is the more noteworthy that over 78 per cent of all cars made in the United States sell at prices below \$1,000, Ford leading with a standard five-passenger touring car costing in the neighborhood of \$350, or 1400 gold marks, Overland following with a five-passenger sedan, with all the appearance and comforts of a closed car, selling at \$695, or 2,800 gold marks. That these low priced cars are built for service and not for dumping grows evident from the fact that in spite of the tremendous wealth available in America, the demand for high priced cars is exceedingly low, only 4 out of 1,000 cars sold in the United States costing more than \$4,000 apiece.

The conclusion which we reach by result of our analysis can be summarized as follows: While the ratio of wages paid by German and American automobile manufacturers, respectively, is 1 to 6, the ratio of prices for relative products is 3 to 1. In other words, the German workingman receives one-sixth of the wages of the American workingman, and the German consumer has to pay three times more for a similar car than the American consumer.

WITH THE EQUIPMENT MANUFACTURERS

Optimism Pervades Convention
(Continued from Page 492.)

Any proportion of blow to run is made by the settings on the front dials without having to stop the control. This can be varied within 1 per cent of the cycle.

The down-run percentage can be varied without making any change to the cycle length or proportion of blow to run.

Hand operation of the gas apparatus is possible at any time by disconnecting the automatic feature of the control from the master valve nest. The gas apparatus may again be put back on to automatic control operation whenever desired.

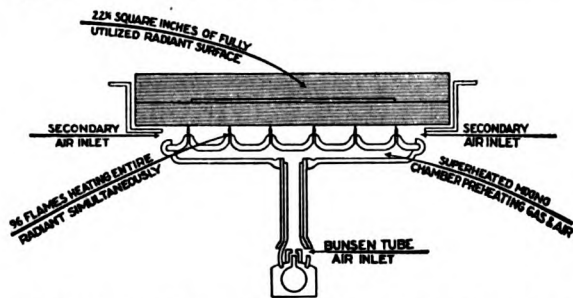


FIG. 3.—The new Superay Radiant Heater—a unique application of radiant heat principle, which recovers from the fuel not only the radiant heat but also the reflected and convected heat.

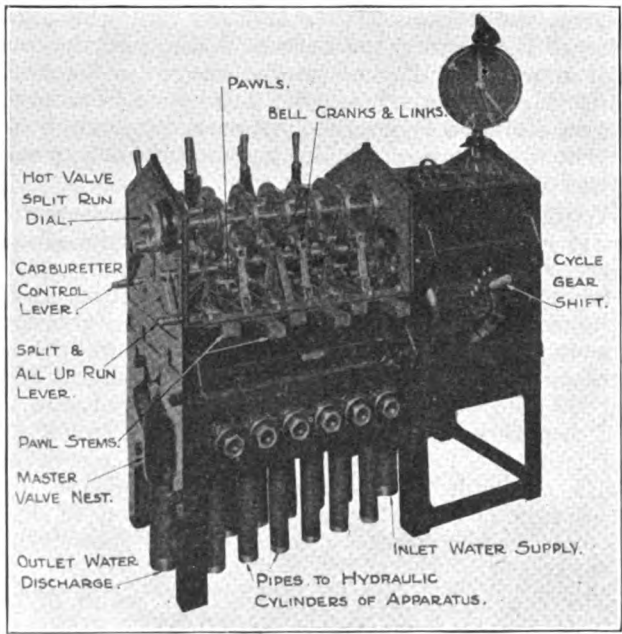


FIG. 4.—Shows the new Model "B" automatic and thermo-control. This equipment is a very compact machine in which the control timing device is mounted directly over a U. G. I. master valve nest, which consists of a series of four-way valves built in single block. The control and the master valve nest are connected through the series of levers shown and the valves of the latter operate the hydraulic cylinders of the valves on the water gas apparatus.

The master valve nest is a series of four-way valves operated by the automatic control timing device, to position the hydraulic cylinders of the gas apparatus valves. By means of the large inlet and outlet pipes, supplying water to the valves, and the large internal port construction of the nest, back pressure is considerably reduced.

The indicator shows the gas maker the exact position of the gas making cycle, without having to be near enough to read the front dials.

Whenever the electric motive power should fail, the control automatically shuts down placing the valves of the gas apparatus in their safe position.

Radio Apparatus

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, radio apparatus to the value of \$43,460,676 was manufactured during the year for sale as such. This total includes 1,889,614 head sets, valued at \$5,352,441; 508,001 loud speakers, valued at \$5,620,961; 414,588 receiving sets of the tube type, valued at \$12,065,992, and 116,497 receiving sets of crystal type, valued at \$550,201, together with the other items shown in the table below. The manufacture of 2,601,575 radio tubes, valued at \$4,572,251, was reported separately. A part of these tubes were sold to manufacturers to complete receiving sets (and their value is therefore included in the total value of such sets, as given above) and the remainder were sold to individual purchasers for use in the construction of home-made sets.

The following table, giving the numbers and values of the several classes of radio equipment reported as manufactured in 1923, is preliminary and subject to such correction as may be found necessary upon further examination of the returns:

PRODUCTION OF RADIO APPARATUS, 1923		
(Reported by 290 establishments)		
	Number	Value
Total value*		\$43,460,676
Loud speakers	508,001	5,620,961
Head sets	1,889,614	5,352,441
Receiving sets, tube type	414,588	12,065,992
Receiving sets, crystal type	116,497	550,201
Transmitting sets	1,073	900,230
Transformers	1,700,024	3,773,213
Rheostats	1,089,721	716,774
Lightning arresters	355,161	196,534
Miscellaneous parts		14,284,330

*Not including tubes for sale as such.

RADIO TUBES, FOR SALE AS SUCH		
	Number	Value
Total	2,601,575	\$4,572,251
Under 5 watts	2,559,206	3,788,167
5 to 50 watts	15,167	80,529
Over 50 watts	27,202	703,555

—Bulletin.

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Trade Notes and Publications

Bulletin No. 48941A, entitled "CR-9006 Enameled Resistor Units," has been issued by the General Electric Company. This is a well illustrated booklet describing the uses and advantages of these units and giving standard ratings and dimensions. Applications are given for several different fields of service. The bulletin contains 18 reading pages.

The Bernitz Furnace Appliance Company of Boston has recently issued Bulletin W. G. descriptive of Bernitz Super Blocks for the lining of water gas generators. These blocks are made of carborundum, but the construction is such that troubles previously experienced with solid carborundum linings are said to be entirely eliminated. The arch design of the block allows expansion without detrimental results to either the setting or the shell of the generator. Instead of the usual solid lining, there is used a perforated construction so as to allow air and steam to come into the sides of the fuel bed as well as through the grates during the blow and up-run respectively. Then during the down-run these perforations or apertures give the gas made additional output. These perforated blocks usually extend to a height of from 36 in. to 48 in. above the grate, depending upon the size of the set and operating conditions. Above these perforated blocks for a height of 16 in. to 32 in. similar blocks are used, but without perforations. This takes us up to a point which is above where clinker trouble is experienced, so from here up the usual standard fire brick construction is continued. It is stated that with the Bernitz construction existing percentages of down-run can be greatly increased because the resulting clinkers, which would ordinarily prohibit the increases, can be readily handled. Of course, the maximum percentage of down-run is naturally different for every machine and for every grade of fuel and can be determined only by actual trial. However, the percentage of down-run has in some cases been increased from 50 to 85 per cent of the run.

Dravo-Doyle Company have ready for distribution a new and interesting Cochrane publication relating to the filtration of water for industrial plant, swimming pool and other uses. The subjects covered are: Cochrane filters and certain interesting features of same; swimming pool and other applications; new type of chemical and coagulating feeding devices; Cochrane zeolite and lime and soda ash water softeners.

W. B. Scaife & Sons Company are distributing a very interesting 32-page booklet on Water Purification, introducing the subject as follows: "Dirty or turbid water is always objectionable for domestic use. The greatest menace to health in water from any source is the presence of the typhoid bacillus introduced by sewage or from surface runoffs in inhabited districts. Filtration removes suspended impurities so that a clear water is obtained, but sterilization in addition to filtration is a necessity for safeguarding domestic supplies, or water used in the preparation of food products. Many water supplies are a constant source of waste and expense to manufacturers on account of the impurities carried in suspension. Turbid water is very objectionable for many industries, such as laundering, dyeing, bleaching, paper-making, distilling, etc. Water containing iron either in solution or

in suspension is unsuitable for those processes where it either enters into the product or comes in contact with it. Purifying water to make it clear and free from iron will correct many of the difficulties encountered in manufacturing plants, and will also insure in many industries the production of more uniform products of high grade. Swimming pools rapidly become contaminated with bacteria that are a menace to health. After a few hours' use the water may contain hundreds of thousands of bacteria per cubic centimeter; so that filtration and sterilization become necessary to safeguard bathers. In addition to filters and filtering systems discussed in this catalog, we also design and build several types of water softening and purifying systems. Over 30 years' experience in designing and installing filters and softening systems for every purpose enables us to supply apparatus perfect in detail to insure water of the desired purity for any specific use. Our long list of satisfied customers for whom we have installed water-purifying apparatus is the best evidence of the value of our service and of our ability to fulfill any guarantees we make."

The Conveyors Corporation of America, 326 West Madison Street, Chicago, announce the appointment of W. P. MacKenzie Company, 1234 Callowhill Street, Philadelphia, as their sales representatives in South-eastern Pennsylvania and Southern New Jersey.

This organization will handle the sale of America Steam Jet Ash Conveyors, American Cast Iron Storage Tanks, American Air Tight Doors for ash pits and boiler settings, and other specialties.

The MacKenzie Company are well known in and around Philadelphia as they have been selling heating, ventilating and power plant equipment for many years.

Associated with Mr. W. P. MacKenzie in the sales organization are Messrs. John Beard, J. E. Fulweiler, S. T. MacKenzie and W. R. Lunn.

In addition to the sales of the American Steam Jet Ash Conveyor the MacKenzie organization handle the sale of the products of Alphons Custodis Chimney Construction Company, International Filter Company, Peabody Engineering Company, L. J. Wing Manufacturing Company, and others.

Orders received by the General Electric Company for the three months ending September 30 totaled \$58,389,832 as compared with \$65,483,549 for the same quarter in 1923, a decrease of 11 per cent, according to a statement made by Gerard Swope, president.

For the first nine months of the present year orders total \$203,097,719 as compared with \$229,747,304 for the same period in 1923, a decrease of 12 per cent.

Arthur G McKee & Company, Engineers and Contractors, Cleveland, have been awarded contracts for extensive improvements to the blast furnace plant of the Delaware River Steel Company at Chester, Pa.

The existing hand filled furnace will be converted into a skip filled unit, the new work including a steel stock trestle with Baker suspension type ore storage bins, coke bin, skip bridge, new furnace top with McKee revolving distributor and electrically operated bell rigs, scale car, skip cars, and other auxiliaries necessary to make the furnace modern and efficient in all respects.

Semi-Steel

By G. W. Gilderman*

Semi-steel is a term that is little understood. The mixtures parading under this title in the past and the manner in which these mixtures have been made have been so varied that, until a few years ago, semi-steel was considered more or less as a joke. There are still a few foundrymen who are under the impression that semi-steel is merely a close-grained iron. As this metal is made today, however, it is well worthy of the name.

Semi-steel is extensively used in internal combustion engine parts. These castings must withstand severe service and so must be strong and close-grained. Whereas the ordinary gray cast iron has a strength of 2300 to 2700 pounds, semi-steel often reaches 3600 pounds before breaking. Bars have been cast that did not break until a load of 4000 pounds was reached; this, however, is not to be expected in everyday practice.

The exact date that semi-steel ceased to be an experiment is not definite. Formerly when a cylinder was to be cast, a few old files were thrown into the ladle and the mixture stirred in order to get a uniform metal. If the casting came out satisfactorily, the files got the credit; if not, everyone stood around and tried to find the answer. Later, steel scrap was added directly to the cupola, first in small amounts, gradually increasing to 40 per cent. The proportion has since been reduced till now 20 to 25 per cent of steel scrap is considered good practice.

Let us take for example a mixture to produce a casting having a thickness of $\frac{3}{4}$ in. The analysis should be: Silicon 1.60 per cent, manganese 0.75 per cent, phosphorus 0.40 per cent, and sulphur about 0.09 per cent. In order to obtain this analysis in the casting, the charge should consist of 60 per cent pig iron, 20 per cent steel scrap, and 20 per cent cast scrap. The pig iron should analyze as follows: Silicon 2.30 per cent, manganese 1.25 per cent, phosphorus about 0.40 per cent, and sulphur less than 0.05 per cent. If the manganese content of the pig iron is too low, the deficiency may be made up by adding ferro-manganese to the cupola.

In making up the charge, the first thing to be considered is the size of the steel scrap that is to be used. If the scrap is heavy, such as the ends of T-rails and I-beams or pieces with a corresponding section, it should be charged directly on top of the coke, keeping a space of about 8 in. next to the wall for pig iron. If the scrap is small, the pig iron should be charged first, then the scrap scattered over the top of the pig iron. Scrap as small as $\frac{1}{8}$ in. thickness may be used in this way.

Semi-steel should be melted hot. The fuel ratio depends of course on the conditions obtaining in each foundry; however, the general practice is not greatly different from gray iron work. An additional 5 per cent of coke is sometimes necessary when using heavy steel scrap. Small charges, 1000 pounds in a 48-in. cupola or 2,000 lbs. in a 60-in. cupola, will usually give the best results. Mixing ladles are necessary when pouring small castings.

Semi-steel must be handled somewhat faster than gray iron. This fact must be considered when de-

termining the size of gates and risers. When a riser is necessary, it should be about 50 per cent larger than if for the same casting in gray iron. In allowing for shrinkage, $\frac{1}{8}$ in. per ft. has been found to be satisfactory.

In the preparation of the mold few deviations from ordinary practice are necessary. More new sand should be used in the facing, as much as one-half in some cases. In no case should the proportion of new sand be less than one-third. In preparing the mold for a casting weighing 500 to 2000 lbs., a skin-dried mold is more satisfactory. The facing in this case should be made up of 20 parts sand and one part of pitch compound. For castings weighing more than one ton, a dry sand facing liberally studded with nails is necessary. The dry sand facing is made by mixing one yard of heavy new sand, 12 cu. ft. of sharp sand, 140 lbs. of flour, and 2 qts. of molasses.

All dried molds should be given a coat of black-wash before being dried. Compound facings can best be dried by means of a torch while dry sand facings must be dried with charcoal.

In order to get a high casting pressure, either a deep cope or a built-up runner box may be employed. When it is not possible to use a churning rod, the riser should be covered with sea coal as soon as the mold is poured.

Pattern proportion is a very important detail in the manufacture of semi-steel castings. Before attempting to make a new casting, the drawings should be carefully examined in order to locate any heavy sections attached to light sections. If such are found, means must be found to feed these portions or chills must be employed to make them solidify as rapidly as the remainder of the casting. This is well illustrated in the case of a blank gear. In this case, we have a heavy section at the junction of the arm and rim next to a comparatively light section of the arm. In a case of this kind, a spongy spot will usually be found at the base of the teeth when cut, unless precautions are taken to prevent such a condition. The usual method of correcting this difficulty is to use a chill made to fit the casting at this intersection and rammed up in the mold. Similar spongy spots are often found in cylinders and pistons.

In making semi-steel castings, a sound clean metal is the principal requirement. Some flux or scavenger is required in the ladle, the ones chiefly used being aluminum, ferro-titanium and ferro-vanadium. Aluminum melts very rapidly and rises to the top, carrying with it most of the gases contained in the molten metal. The aluminum is rapidly oxidized and enters the slag in that form, leaving little or none of that metal in the casting. Ferro-titanium acts in much the same way as aluminum in that it removes gases. Its action is, however, more intense. When a large amount of this alloy is used, some of it will be found in the casting, but if only a small amount is used, the casting will be practically free from titanium. One ounce of 15 per cent ferro-titanium for each hundred pounds of iron gives very satisfactory results. Ferro-vanadium is used extensively in the manufacture of piston rings. Its principal value lies in the fact that it breaks up the large graphite flakes, thereby strengthening the casting. Iron treated with ferro-vanadium will withstand repeated shock better than an iron not so treated. Two ounces of 30 per cent ferro-vanadium is enough to treat 100 pounds of iron.

—Purdue University Bulletin No. 6.

*Superintendent of Foundries, Dodge Manufacturing Company, Mishawaka, Ind.



Experienced Alloy Steel Man Joins United Alloy Organization

Effective at once, L. G. Pritz has been appointed vice president in charge of all operations of the United Alloy Steel Corporation. Mr. Pritz has had a very broad steel experience. Starting at the South Chicago plant of the Illinois Steel Company in 1909, Mr. Pritz has served as turn foreman, melter, superintendent of electric furnace, and superintendent of special high grade steels. This company operates and produces steels made by all the processes, except the crucible, including Bessemer, basic and acid open hearth, and electric furnace.



Resigning as metallurgical engineer in charge of the high grade specialty and alloy steel department, he became associated with the Timken Roller Bearing Company in 1917. Resigning in 1922 as general superintendent of the steel works where he had charge of electric furnaces, rolling mills and tube plant in the production of bearing steels, he became associated with the Sizer Steel Corporation of Buffalo as vice president, specializing in the production of bar steel, die block steel, tool steel, bit steel and alloy steels for automotive parts.

Mr. Pritz, while still a comparatively young man, is one of the oldest electric furnace men in the United States, and comes to the Alloy organization well fitted to carry on the work of producing alloy and specialty steels of the highest standard of quality.

Mr. Harry Hodgetts, formerly superintendent of furnaces for the Joseph E. Tropp Company, Inc., of Earlston, Pa., has resigned to undertake the develop-

ment of the extensive properties of the Tatesville Silica Sand Company, of Everett, Pa. Mr. Hodgetts was formerly superintendent of furnaces, Pittsburgh Crucible Steel Company, Midland, Pa., and at various intervals has been associated with Republic Iron & Steel Company, Struthers Furnace Company, and the Carnegie Steel Company, Youngstown, Ohio.

At a recent meeting of the directors of the Empire Rolling Mill Company, Cleveland, Mr. Justin Griess was elected a director to fill the vacancy caused by the death of A. W. Ellenberger. Mr. Griess is vice president of the McMyler-Interstate Company, Cleveland.

Jones & Laughlin Steel Company have under way at their South Side plant in Pittsburgh an extensive enlargement to the soaking-pit capacity for the 40-in. blooming mill. Where this mill was formerly supplied by 24 8-ingot pits, the extension calls for 42 of the same size pits. This mill rolls an 18x18-in. ingot and the added capacity will materially increase the hot storage of steel, with a resultant total tonnage output.

Mr. Wm. A. Blockinger, superintendent of the sheet department, Columbia Steel Corporation, Pittsburgh, Calif., has resigned to accept a similar position in Alabama. He is now superintendent of the sheet department, Tennessee Coal, Iron & Railroad Company at the new plant near Ensley, where large scale production of black and galvanized sheets may soon be expected.

Tennessee Coal, Iron & Railroad Company are making progress in the installation of four 100-ton open hearth furnaces at their new plant near Ensley, Ala. This additional ingot capacity is called for by the operating schedule of the new sheet and jobbing mills at this plant.

Walter J. Willis, superintendent of the Depew, N. Y., works of the Gould Coupler Company, Inc., is in Europe, his itinerary including a number of steel foundries in France and Germany.

Some Pointers on By-Product Coke Oven Operations

To Install Koppers Coal Gas Plant.

The Consumers' Power Company has recently placed a contract with the Koppers Company of Pittsburgh for a Koppers coal gas plant to be installed for their Jackson, Mich., property.

This plant will consist of 15 Koppers Company Becker type gas ovens, together with one producer. The plant will have a capacity of approximately 1,600,000 cu. ft. of 550 Btu. gas per day.

To Build 175-Mile Natural Gas Line

Following the recent taking over of the holdings of all of the larger natural gas producing companies in the Amarillo field by subsidiaries of the Prairie Oil & Gas Company, comes the official announcement that these interests will immediately construct a natural gas pipe line from Amarillo to Lamesa, about 175 miles. The proposed pipe line will serve more than 20 towns, including Canyon, Plainview, Lubbock, Slaton, Tahoka, O'Donnell, Lamesa and a number of smaller communities along the route.

In view of the fact that the territory to be covered is treeless and that coal is now the exclusive fuel for domestic purposes, it is expected that the coming of natural gas will be of great economic value. Most of the coal supply comes from the mines at Dawson, N. M., and sells for high prices, in some instances as much as \$25 a ton. The natural gas supply already developed in the Amarillo field is many times more than would be required to supply the towns that are to be reached by the new pipe line, it is stated.

Order Placed with Steere Company for Scrubber.

The Steere Engineering Company of Detroit, Mich., has received an order for an intensive scrubber from the U. G. I. Contracting Company for the plant extensions they are making for the Syracuse Lighting Company.

In March of this year Henry L. Doherty and Company announced the acquisition, through Combustion Utilities Corporation, of the Surface Combustion Company, Inc., Industrial furnace engineers and manufacturers.

Combustion Utilities Corporation has just announced the consolidation of the personnel and activities of its appliance and industrial furnace departments with those of the Surface Combustion Company, Inc. The greater organization continuing under the name of the Surface Combustion Company, Inc., will be the utilization department of Combustion Utilities Corporation.

Under the consolidation Henry O. Loebell continues as president of the Surface Combustion Company, Inc.; E. E. Basquin, vice president and general manager; W. M. Hepburn, vice president; Frank H. Adams,

treasurer; and E. M. Doig, secretary. Paul J. Nutting, formerly in charge of Toledo Appliance Division of Combustion Utilities Corporation, becomes vice president in charge of production. C. B. Phillips, former sales manager Toledo Division, becomes vice president and sales manager of the Stock Furnace Division, which will include all the well-known "Improved" and "Utility" appliances, and the "Blue Line" furnaces. F. W. Manker, previously in charge of Combustion Utilities large furnace department, becomes vice president and will be associated with Mr. Hepburn in the Large Furnace Division.

The Surface Combustion Company, Inc., sales and general offices will be continued at 366-368 Gerard Avenue, New York, and all production at the Toledo Works, 2288 Albion Street, Toledo, Ohio.

In commenting on this consolidation Mr. Loebell said, "This consolidation unites in one unit the utilization, engineering and sales personnel of these two organizations, so well-known 'wherever heat is used in industry'. It brings to all industries the skilled services of the largest family of combustion engineers, whose skill is exemplified in equipment for the utilization of fuel with the utmost economy, but which makes for easier control. We will continue to forge ahead and force progress in efficient fuel utilization in industry, by providing a complete line of furnace equipment, and a well rounded organization to assist all industry in its great strides forward."

The By-Products Coke Corporation, Chicago, Ill., has arranged for the installation of a new sintering plant at its Federal furnaces at South Chicago, to be designed for a daily output of 250 tons of sinter from blast furnace flue dust. The plant will be built by the American Ore Reclamation Company, operated under a license for the Dwight & Lloyd sintering process. It is expected to be ready for service during the coming year.

New Type Oil Burner

The Combustion Engineering Corporation is distributing a pamphlet recently issued on a new type oil burner called The Quinn P.G.S. Burner.

It is obviously a very economical plan for oil refineries to burn the heavy sedimentary oils in order that they may release all the better grade oils to the general market. In the past this has seldom been possible due to the inability of any one type of burner to suit itself to oils of this kind and the other requirements of refinery practise.

Although the burner described in this folder is applicable to stationary boilers or to the burning of oil for any purpose it has been especially designed for refinery work. Thorough tests have proved beyond question its ability to meet any and all refinery conditions.

NEWS OF THE PLANTS

The Belfont Steel & Wire Company, Ironton, Ohio, will hold in abeyance the construction of its proposed new steel plant on site adjoining its present works, recently announced, and will continue production under the present status at its blast furnaces and wire mills. Necessary alterations and improvements will be made in the existing works in connection with the general betterment program as previously arranged. The company owns a controlling interest in the plant of the Ashland Steel Company, Ashland, Ky., where a number of improvements have lately been made for increased production and greater efficiency in operation. The Belfont company will secure rods and other materials from this source. I. P. Blanton is president, and S. G. Dilfillan, vice president.

Plans are under way for the construction of a large steel fabricating works at Boyles, Birmingham, Ala., understood to be carried out by a new company, name temporarily withheld. The Birmingham Real Estate Board, J. L. Yancy, president, is interested in the project, and will give out information, it is stated, at an early date. The plant will be located on a 500-acre site and will consist of a group of buildings, including power house and other mechanical structures, with cost estimated in excess of \$1,000,000, including machinery. A list of the fabricating and other steel mill equipment to be installed will be arranged in the near future.

The Bethlehem Steel Company, Bethlehem, Pa., has extended the program for expansion and betterments at its Lackawanna plant at Buffalo, N. Y., and in addition to the new 35-in. roughing mill and 28-in. structural mill recently announced, will build a 44-in. blooming mill and 18-14-in. structural mill. Work on the structures will proceed at an early date. Other extensions and improvements will be carried out at the existing mills, including the installation of considerable equipment and electric power apparatus. The company has decided to build two new 18-14-in. structural mills at its Johnstown, Pa., works and will proceed with this expansion at an early date. The new mills will be electrically operated.

The Compania Electrica Siderurgica y Industrial de Valdivia, Santiago, Chile, has recently perfected its organization for the construction of a local steel works and is now negotiating for final concessions from the government of Chile to carry out the proposed project. The plant will consist of a number of one-story mill units, to be equipped for an initial monthly output of about 2,500 tons and which will be increased at a later date. Electric furnaces will be installed and all other machinery will be of latest approved type. It is said that the projected works will involve in excess of \$700,000. The Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., has received information regarding the enterprise from William M. Collier, ambassador at Santiago.

The Delaware River Steel Company, Chester, Pa., has plans under way for the construction of a new ore dock at its plant at the foot of Wilson Street. The new dock will be 65 ft. wide and 450 ft. long, and will

provide facilities for handling the largest ore-carrying vessels afloat. Machinery for complete mechanical operation will be installed, including traveling cranes, unloading apparatus, etc. Application to proceed with the work has been made to the Commissioners of Navigation, and it is expected that permission will be granted at an early date.

The Struthers-Wells Company, 1009 Pennsylvania Avenue, Warren, Pa., has awarded a general contract to the McClintic-Marshall Company, Oliver Building, Pittsburgh, Pa., for the erection of a new one-story addition at its steel plant and plate mills, to provide for increased capacity. It is expected to proceed with the work immediately. John T. Dillon is president.

The Jones & Laughlin Steel Corporation, Pittsburgh, Pa., is reported to be perfecting plans for the early erection of the initial units of its proposed new steel mill at Hammond, Ind., projected a number of months ago and held in abeyance since that time. The company has a tract of 1,200 acres at this locality and has recently been acquiring additional property for right-of-way purposes for the construction of an outlet sewer and drain from the mill site, leading to the Calumet River. The Pennsylvania Railroad Company has also purchased a right-of-way to the plant site from its main line, a distance of about two miles. Plans for the plant provide for a number of one-story mill units, with power house and other mechanical buildings, reported to involve in excess of \$5,000,000.

Evan F. Jones, recently with the Wickwire Spencer Steel Corporation and with the Morgan Construction Company, has been made general manager of the Atlas Die Casting Company, Worcester, Mass., and has entered upon his new duties. A. W. Hutton remains with the company as chief engineer.

Recent awards for river improvement work have come to manufacturers in the Pittsburgh district. H. P. Gazzam Machine Company received a contract to furnish river wall valves for lock No. 49 and No. 50, Ohio River. There is a total of 175,508 pounds of cast iron; 43,408 pounds of cast steel and 3,372 pounds of phosphor bronze. The chief of engineers also approved the award of the Louisville district to the Stroh Steel Hardening Process Company of a contract to furnish 19,744 pounds of steel castings for locks No. 40 and No. 50, Ohio River. The J. & J. B. Milholland Company received a contract from the Louisville district for the delivery of 13,758 pounds of steel reinforcing bars and 5,000 pounds of miscellaneous steel for locks No. 49 and No. 50. The total amount, exclusive of bronze, amounts to more than 123 tons.

Rebuilding of some of the old buildings of the Steel Company of Canada, Ltd., Hamilton, Can., has been undertaken. The old buildings at the Swansea plant which have been out of repair, will be modernized. The company does not expect an increased output to result from the betterments, but merely an improvement in plant conditions.



Positions Wanted and Help Wanted advertising inserted under proper headings free of charge. Where replies are keyed to this office or branch offices, we request that users of this column pay postage for forwarding such replies. Classified ads can be keyed for the Pittsburgh or New York offices.

POSITION WANTED

SUPERINTENDENT of sheet mill desires to make a change; has had years of experience in the rolling of light iron and high grade auto and metal furniture sheets; can furnish reference. Box X X X, care of The Blast Furnace and Steel Plant.

MELTER, 18 years practical experience. Open Hearth and Electric, leading European makers high grade steels, age 35, wants position where his knowledge and experience can be used. Highest references. Box 301, care of The Blast Furnace and Steel Plant.

POSITION WANTED—Cold strip mill superintendent with thorough knowledge in operating. Can apply latest methods to produce highly finished material. Twenty years' experience; reliable references. Box 000, care of The Blast Furnace and Steel Plant.

MASTER MECHANIC with 30 years' experience on construction and operation of steel mills, blast furnaces, open hearths, Bessemer departments, by-product coke plants; constructed hydro and steam electric plants, large pumping stations, etc.; at present employed, wish to make change. Box 100, care of The Blast Furnace and Steel Plant.

CHIEF DRAUGHTSMAN—Broad and varied experience in general engineering, mechanical, structural, electrical, designing machinery, tools, power, structural steel, concrete and industrial buildings; purchase, installation and plant maintenance. Address Box A M B, care of The Blast Furnace and Steel Plant.

DESIGNING ENGINEER, experienced executive with technical training, desires position as chief engineer or master mechanic. Fifteen years' experience, including design and construction of rolling mills, furnaces, plant equipment, power plants, special machinery, etc.; four years in machine shop. Address Box F C M, care of The Blast Furnace and Steel Plant.

POSITION WANTED—A graduate mechanical engineer with 12 years' experience in rolling mills, desires a position as superintendent or assistant. Experience covers every job in a rolling mill from laborer to assistant superintendent. Also has had some office and sales training. At present employed, but desires a better outlook. Box C A S, care of The Blast Furnace and Steel Plant.

POSITION by chemist, technical graduate. 15 years experience glass, animal fats, bleaching iron and steel. Six years experience as plant executive. Research work a specialty. Box L, care of The Blast Furnace and Steel Plant.

YOUNG rolling mill superintendent with 20 years' practical experience on iron and steel Belgian type mills, also latest continuous type steel mills, desires to make change. Can furnish records and references. Have practical knowledge of rolling and roll designing. Box F A W, care of The Blast Furnace and Steel Plant.

ENGINEER, Cornell graduate, seven years' steam and fuel engineering, three years' executive experience as master mechanic of a rolling mill, three years' sales engineering, desires change. Box S, care of The Blast Furnace and Steel Plant.

POSITION WANTED

ENGLISHMAN, 23, of sound general and technical educations, with seven years' experience of steel making by open hearth process (acid and basic) in prominent English steel works, desires appointment where scientific and practical knowledge would be an asset. Box G B J, care of The Blast Furnace and Steel Plant.

WANTED—A position wherein the following will be of value: A fair technical education, a large amount of practical experience in the various mechanical arts and plant operation and maintenance with an eye on the "works operating expense" account, a fair degree of executive ability and absolute dependability. Experience has been had in production and general machine shops, rolling mills, rod and wire mills and at blast furnaces. Expert in design and construction of the Dwight and Lloyd type of sintering plant. Box C C C, care of Blast Furnace and Steel Plant.

CHEMICAL ENGINEER, 1922 graduate, leading university, desires position in a steel plant. One year's experience in the inspection department. At present employed, but available on short notice. Box J B C, care of Blast Furnace and Steel Plant.

POSITION WANTED—Electric furnace man open for position; experienced on basic Heroult electric furnaces, tool and alloy steels. Box A T, care of The Blast Furnace and Steel Plant.

HEATER on soaking pits or reheating furnaces; 10 years' mill experience; can give references. Box C Z, care of The Blast Furnace and Steel Plant.

SALES POSITION with manufacturers' sales agent for power plant specialties or chief draftsman or plant engineer with moderate sized manufacture. Box K, care of The Blast Furnace and Steel Plant.

I DESIRE to have a position as tracer or on small drafting work with reliable concern, preferably in mechanical line. Box J, care of The Blast Furnace and Steel Plant.

YOUNG MAN, technical graduate and 7 years' practical experience, would like to connect with organization needing a producer. Prefers a job which keeps him on the road the major portion of the time. He has intensive education along lines of general inspection of materials. Box I, care of The Blast Furnace and Steel Plant.

POSITION as field engineer, construction work, general survey work and right-of-way work. Box G, care of The Blast Furnace and Steel Plant.

POSITION WANTED by chemical engineer, degree of doctor-engineer (1916) from leading German university, 33 years old, six years' experience embracing the analysis, metallography and physical testing of steel and alloys. Nationality, Norwegian. Languages, Norwegian, Swedish, German and English. Location, anywhere. Available, any time. Can furnish best of references. Box R E D, care of The Blast Furnace and Steel Plant.

TIME KEEPER—Have had several years experience. Box H, care of The Blast Furnace and Steel Plant.

YOUNG MAN with five years' experience as machinist and three years' experience in foundry. Tech graduate, wishes position with growing firm at or near Philadelphia, Pa. Box W B, care of The Blast Furnace and Steel Plant.

POSITION WANTED

CHIEF CLERK or assistant to works manager; 32 years old, married. Ten years' experience in sheet and tin rolling mills, galvanizing, long terne and factory record and office work. Experienced from time-keeping to corporation yearly statement, including cost. Box L E T, care of The Blast Furnace and Steel Plant.

ROLLING MILL superintendent, experienced in the heating and rolling of carbon, alloy and electric furnace steels, desires position; experienced in blooming, plate and universal mills. Highest references. Box A R T, care of The Blast Furnace and Steel Plant.

POSITION WANTED by experienced roll turner and designer. Have had several years' experience in charge of roll shops, designing, etc., as well as turning rolls. Have also had experience working on the mills. Can handle position of mill superintendent, roll designer or boss roll turner. Can furnish best of references. Box P V C, care of The Blast Furnace and Steel Plant.

POSITION WANTED—Steel mill electrical engineer desires change in location. Five years' engineering and operating experience in steel mills. Technical graduate, member A. I. & S. E. E., Associate A. I. E. E.; age 32. Box A R L, care of The Blast Furnace and Steel Plant.

YOUNG MAN, technical education, desires position in Pittsburgh District as chemist on analysis of open hearth steels. The applicant is at present employed in steel work, but desires a connection offering greater possibilities. Details as to past experience and recommendations will be submitted on request. Box G P G, care of The Blast Furnace and Steel Plant.

WANTED—Position on maintenance in medium sized steel plant or factory; 12 years' drafting room experience on general mill engineering and three years' machine shop experience. Box F D J, care of Blast Furnace and Steel Plant.

POSITION WANTED—Blast furnace superintendent, twelve years practical experience as blast furnace master mechanic, general foreman and assistant superintendent, thoroughly familiar with metallurgy of iron, maintenance of plant, Bessemer, foundry, Spiegle, ferro silicon and ferro manganese, also up-to-date in best cost practice, technical education; employed at present. Address Box F W H, care of The Blast Furnace and Steel Plant.

PHOTOGRAPHER—Thoroughly competent to take charge of photographic department in industrial concern; experienced steel mill man; reference furnished. Address Box C B S, care of The Blast Furnace and Steel Plant.

FIELD ENGINEER, desires change. Technical training and nine years experience on construction and maintenance of steel plants; also general surveys; 30 years old and married. Box 200, care of The Blast Furnace and Steel Plant.

POSITION WANTED—Assistant superintendent open hearth or bloom mill. Have had quite a number of years' experience in open hearth and bloom mill practice, believe in quality steel and can furnish best of references. Box T, care of The Blast Furnace and Steel Plant.

POSITION WANTED—Chemist and engineer desires responsible connection; experienced in both blast furnace and steel plant. Box C A N, care of The Blast Furnace and Steel Plant.

Co-operate:—Refer to The Blast Furnace and Steel Plant

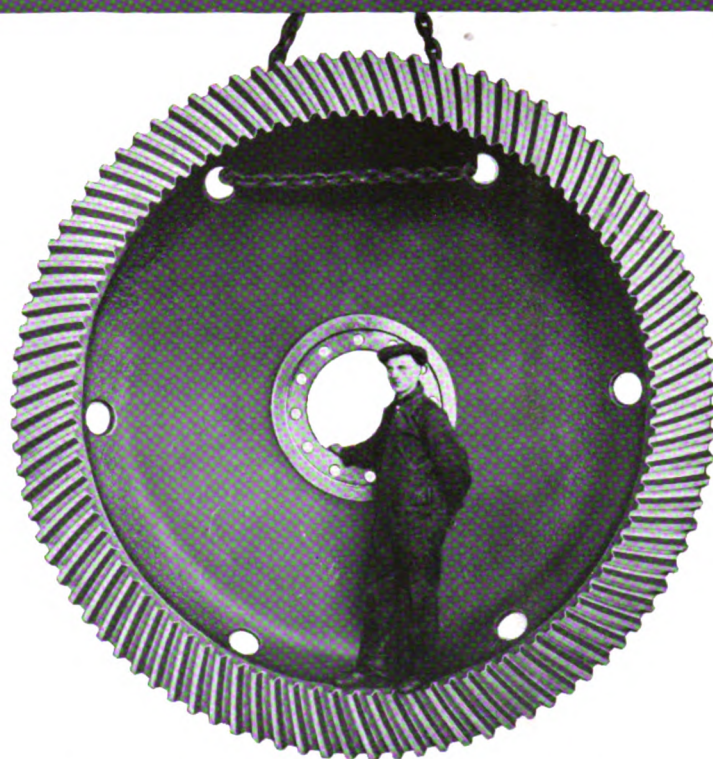
The Blast Furnace *(and)* Steel Plant

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